ARCTIC

OHIO STATE UNIVERSITY
SEP 21 1957
LIBRARY

VOLUME 3, NUMBER 1 · APRIL 1950

JOURNAL OF THE ARCTIC INSTITUTE OF NORTH AMERICA

THE ARCTIC INSTITUTE OF NORTH AMERICA

Officers and Staff
1950

Chairman
RICHARD FOSTER FLINT

Vice-Chairman
H. L. KEENLEYSIDE

Secretary
M. J. DUNBAR

Treasurer
JOHN C. REED

Executive Director
A. L. WASHBURN

Director, Montreal Office
P. D. BAIRD

Director, New York Office
WALTER A. WOOD

Director, Baltimore-Washington Office
M. C. SHELESNYAK

Executive Secretary
MARGARET C. MURRAY

Editor of the Institute Journal *Arctic*
DIANA ROWLEY

Board of Governors

D. W. BRONK, Baltimore, Md.
C. H. D. CLARKE, Toronto, Ont.
M. J. DUNBAR, Montreal, Que.
RICHARD FOSTER FLINT, New Haven, Conn.
ERNEST GRUENING, Juneau, Alaska
A. D. P. HEENEY, Ottawa, Ont.
ERNEST M. HOPKINS, Montpelier, Vt.
H. L. KEENLEYSIDE, Ottawa, Ont.
TREVOR LLOYD, Hanover, N.H.
T. H. MANNING, Ottawa, Ont.
EJNAR MIKKELSEN, Charlottenlund, Denmark
J. J. O'NEILL, Montreal, Que.
JOHN C. REED, Washington, D.C.
FINN RONNE, Chevy Chase, Md.
EDWARD H. SMITH, New York, N.Y.
R. E. STAVERT, Montreal, Que.
A. L. WASHBURN, Montreal, Que.
J. TUZO WILSON, Toronto, Ont.
WALTER A. WOOD, New York, N.Y.

Offices of The Arctic Institute of North America

3485 University Street, Montreal, Quebec, Canada
Audubon Terrace, Broadway and 156th Street, New York 32, N.Y., U.S.A.
Rogers House, The Johns Hopkins University, 3506 Greenway, Baltimore 18, Md., U.S.A.

ARCTIC

Journal of the Arctic Institute of North America

Vol. 3, No. 1 Published in Ottawa, Ontario **APRIL 1950**

CONTENTS

Cover Picture: Pulsatilla ludoviciana, one of the earliest and most beautiful of the flowers of the northwestern Canadian Arctic *(Photo: A. E. Porsild)*

A Preliminary Account of the Danish Pearyland Expedition, 1948-9. *P. C. Winther and others* 3

Studies of the Biology and Control of Biting Flies in Northern Canada. *C. R. Twinn* 14

The Reindeer Industry in Alaska. *Margaret Lantis* 27

A Biological Exploration of Banks and Victoria Islands. *A. E. Porsild* 45

Some Notes on the Soviet Arctic during the Past Decade. *William Mandel* 55

An Unusual Archaeological Specimen from Foxe Basin. *Graham Rowley* 63

The Upper Air over Northern Canada. *Review by F. Kenneth Hare* 66

Book Reviews 67

Institute News 68

Arctic Institute Research Reports 70

Geographical Names in the Northwest Territories 72

Elections of Fellows 72

Arctic is published under the direction of the Board of Governors of the Arctic Institute of North America. The Institute is a non-profit organization whose object is to encourage scientific exploration and study of the Arctic.

Particulars with regard to Associate Membership in the Institute, which includes subscription to *Arctic*, may be obtained from: The Arctic Institute of North America, 3485 University Street, Montreal, Canada, or, The Arctic Institute of North America, Inc., Audubon Terrace, Broadway at 156th Street, New York, N.Y., U.S.A.

COPYRIGHT REGISTERED 1950

Photo: K. Holmen

Meadow with cotton-grass (*Eriophorum Scheuchzeri*) on the south coast of Brønlund Fjord, 2 August 1947.

A PRELIMINARY ACCOUNT OF THE DANISH PEARYLAND EXPEDITION, 1948-9

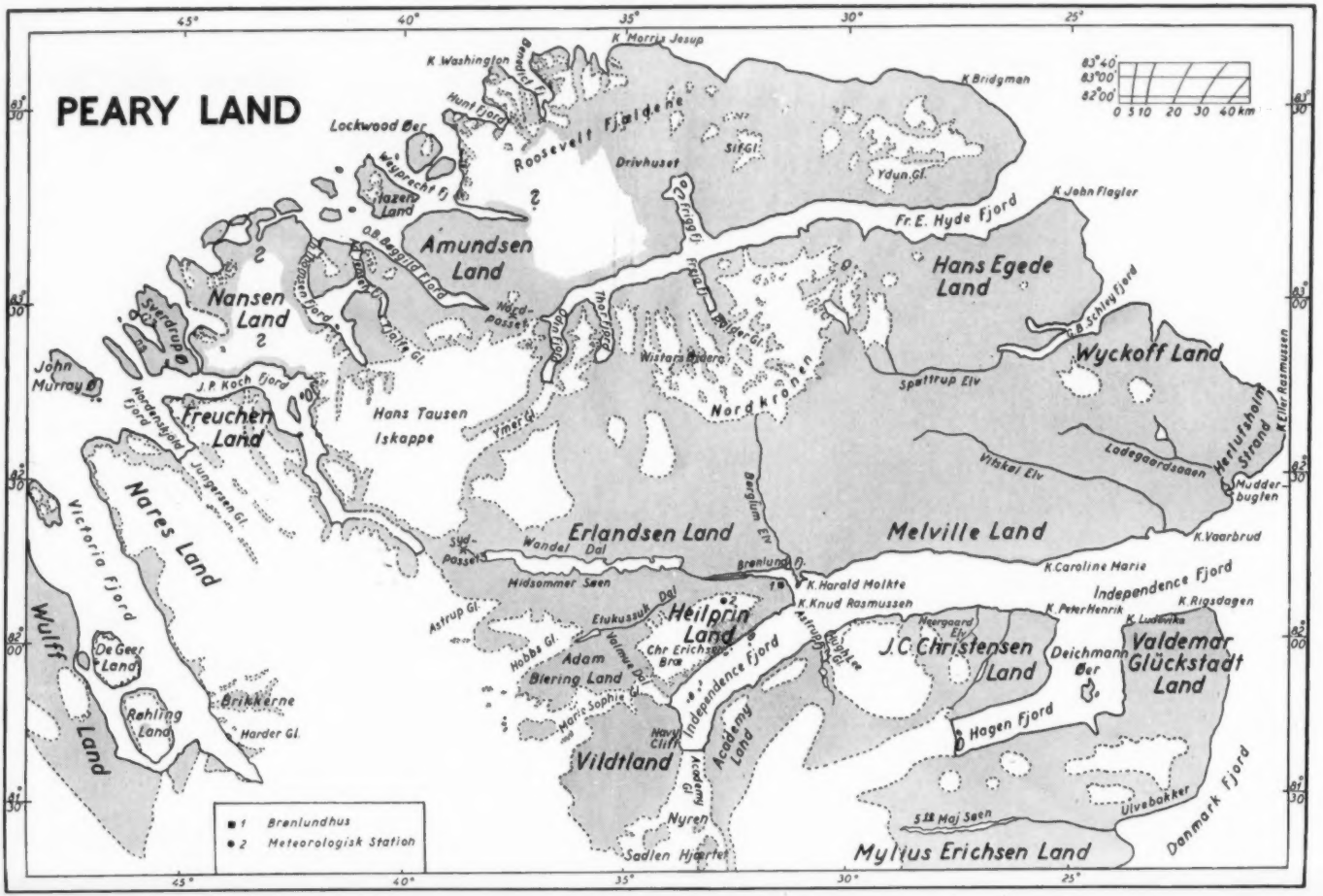
***By* P. C. Winther and other members of the expedition**

EIGIL Knuth and Ebbe Munck had hoped to reach the northernmost part of Greenland, the area north of Independence Fjord called Peary Land, on their North East Greenland Expedition in 1938-9. Owing to unfavourable ice conditions the expedition ship, *M.V. Gamma*, was not able to sail farther north than Danmarkshavn in latitude 77°N., and a winter base was established in Mørkefjord. During the winter several sledge parties approached Peary Land, and experience gained on these trips intensified their ambition of a thorough scientific investigation of this region. Previous land exploration had consisted of sledge journeys, by Danish and American explorers mainly, on which it had not been possible to carry out detailed scientific work. Of these the Peary Expeditions between 1891 and 1909 and Lauge Koch's Jubilee Expedition of 1920-3 are the best known.

After the war Eigil Knuth's and Ebbe Munck's plan for an expedition to Peary Land was made possible by funds provided partly by a grant from the Danish Government, partly by contributions from Dansk Ekspeditionsfond (Danish Expedition Foundation), a recently formed institution financed mainly by Danes living overseas. A Danish Pearyland Expedition Committee was formed in 1946, consisting of the heads of the institutions and bodies which had given support, and scientific representatives from Copenhagen University. Eigil Knuth, the leader of the expedition, was to be responsible for all practical arrangements. The Royal Danish Navy placed Catalinas and their crews at the disposal of the expedition and the Grønlands Styrelse arranged for supplies to be carried to northeast Greenland in their ships.

It was not considered practicable to transport supplies to the winter base in Peary Land by ship, owing to the unpredictable extent of the ice on the northeast coast of Greenland. It was therefore decided to divide transportation into two stages, and to set up a south base which ships could reach each summer with reasonable certainty. From the south base supplies would be flown to Peary Land in Catalinas. Flying boats are very suitable for this kind of work and Catalinas have a fairly long range and carry a pay-load of 2 tons.

This scheme for establishing a winter base in Peary Land was dependent on the existence of sufficient open water for the Catalina to land and discharge supplies. A reconnoitring expedition was therefore sent out in the summer of 1947. The site for the south base was chosen in Young Sund, north of Clavering Ø, 74°16N. The expedition ship, *S.S. Godthaab*, sailed from Copenhagen on July 1 and twenty-four days later anchored


PEARY LAND
K. Washington
K. Morris Jesup
K. Bridgman
Lockwood Bræ
Hunt Fjord
Roosevelt Fjelde
Drivhuset
Sif Gl.
Ydun Gl.
Weyprecht Fj.
Hazen Land
Amundsen Land
Fr. E. Hyde Fjord
K. John Flegler
Hans Egede Land
Nansen Land
Sverdrup Gl.
Nansen Fjord
Fraser Fjord
Aa. Bergild Fjord
Nordpasset
Fraser Gl.
Wyckoff Land
B. Schley Fjord
John Murray Bj.
J.P. Koch Fjord
Freuchen Land
Hans Tausen Iskappe
Wistarhjørne
Nordkronen
Spottrup Elv
K. Chr. Rasmussen
Herlufsholm Strand
Lodegaardsaaen
Vilskel Elv
Mudderbugten
Nordenskjøld Fjord
Jungersen Gl.
Nares Land
Victoria Fjord
Erlandsen Land
Melville Land
Bersalum Elv
Brønlund Fj.
K. Vaarbrud
Wandel Dal
Midsommer Søen
K. Caroline Marie
Independence Fjord
K. Harald Holkte
K. Knud Rasmussen
K. Peter Henrik
K. Rigsdagen
K. Ludovika
Heilprin Land
Etukusuk Dal
Astrup Gl.
Hobbs Gl.
Adam Biering Land
Chr. Erichsens Bræ
Volumen Dal
Meergaard Elv
J.C. Christensen Land
Deichmann Bær
Valdemar Glückstadt Land
Wulff Land
De Geer Land
Rehling Land
Brikkerne
Harder Gl.
Marie Sophie Gl.
Navy Cliff
Academy Land
Academy Gl.
Hagen Fjord
Vildtland
Nyren
Sadlen Hjørtet
5. 18 Maj Søen
Ulvebakker
Danmark Fjord
Mylius Erichsen Land
1 Brønlundhus
2 Meteorologisk Station
0 5 10 20 30 40 km

off the south base in Young Sund, under Zackenberg mountain. At the same time the Catalina "Mallemuk" of the Royal Danish Navy also arrived.

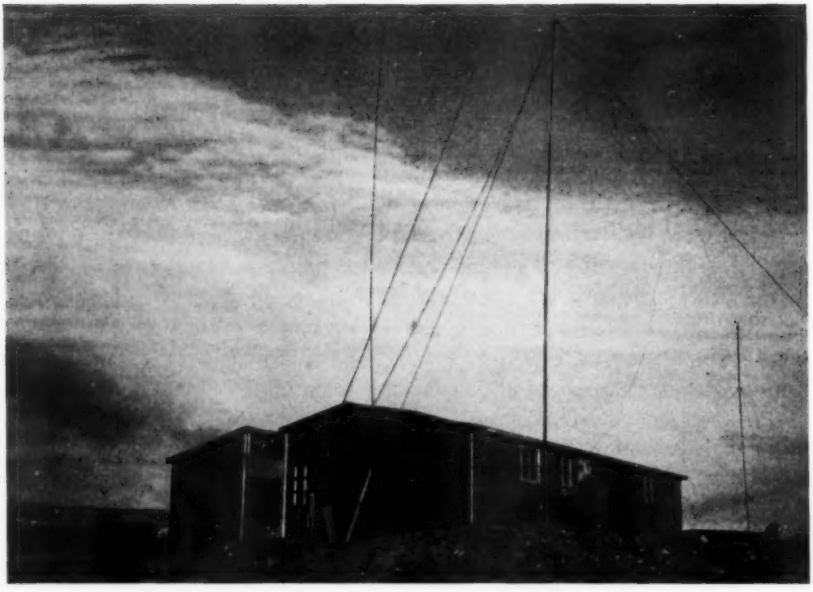
On July 27 the Catalina left for Peary Land carrying Eigil Knuth and a party of eight men including a geologist, a botanist, a zoologist, a glaciologist, and a radio operator. After 6 hours' flight it was discovered —as was hoped and expected—that the small Jørgen Brønlund Fjord, a branch of Independence Fjord, was free of ice. The small party and their supplies were landed on the southern coast of the fjord at the place which was later chosen for the site of the winter base. Owing to an accident to the aircraft when landing at the south base, the party at Brønlund Fjord had to remain there for a fortnight. The scientists spent the time making a preliminary survey of the immediate surroundings of the site for the winter base to assist them in preparing a research program for the winter of 1948-9.

Unfortunately the delay caused by this accident prevented the original plan of making several flights with supplies to Peary Land. By the time the aircraft had been repaired it was possible only to fetch back the party from Brønlund Fjord. New ice was forming on the fjord and the rapidly approaching winter made an immediate departure of ship and Catalina from the south base advisable.

During the winter of 1947-8 the detailed working program of the expedition was prepared as far as the limited knowledge of the country would permit. The hut for the winter base was designed to measure 23 x 23 feet, and to have six rooms. It was also hoped that a small hut could be built at some distance from the main hut for keeping spare clothing and provisions as a fire precaution. The first wintering party was to consist of:

Eigil Knuth, archaeologist and leader
Johannes Troelsen, geologist
Kjeld Holmen, botanist
Palle Johnsen, zoologist
Børge Fristrup, glaciologist
Aage Jacobsen, radio operator
Aage Sahlertz, assistant and cook
Karl Filemonsen, Greenlander

The main expedition arrived at the south base in Greenland towards the end of July, 1948, and the flights from Zackenberg camp to Brønlund Fjord were begun. With the help of three Catalinas twenty-two flights were made and 37 tons of supplies, including such things as materials for the hut, food, fuel, scientific equipment, household articles, dogs, sledges, and hunting and fishing gear, were carried north. The wintering party was fully occupied for the first weeks after the last plane left Brønlund



Winter station in Brønlund Fjord.

Fjord in erecting the house, securing it against the storms expected with the first snowfall, and arranging supplies in the very limited space available. The first snowfall occurred in September and by September 20 the fjord had frozen over and was safe for sledging. It was therefore possible to make several sledge trips into the interior before the total winter darkness prevented the party from leaving the station. On October 16 the sun finally disappeared to reappear on 26 February 1949.

The following brief summaries describe the work carried out and the results obtained on sledge journeys and on walking and motor boat trips during the first wintering of 1948-9.

Geology (*By Johannes Troelsen*)

Geological investigations were carried out in the vicinity of Brønlund Fjord (August 1947) and along Midsommer Søen, J. P. Koch Fjord, the south coast of Peary Land, G. B. Schley Fjord, and the southwestern coast of Independence Fjord (1948-9). The darkest winter months were partly occupied by magnetic observations near the base camp at Brønlund Fjord.

Tillites were discovered among the sediments of the eo-Cambrian Thule group. These indurated glacial drift deposits are always of interest as indicators of pre-Pleistocene glaciations.

On the foreland of the Franklinian (Smith Sound) geosyncline Early

Cambrian, Late Canadian (Lower Ordovician), Middle Ordovician and Silurian fossils were collected. Around Schley Fjord, where the Lower Paleozoic strata are somewhat folded, detrital sediments were found to be slightly more common than on the foreland.

In eastern Peary Land, the folded Lower Paleozoic sediments are uncomformably overlain by marine strata of Pennsylvanian (Triticites), Early (?) Permian, and Triassic age. Beds with petrified wood and leaves of deciduous trees may be of Cretaceous or of Cenozoic age. Rotated faults and local folding have affected the strata after the deposition of the last-mentioned formation.

Basic intrusives of eo-Cambrian (?) age penetrate the Thule group, while other intrusives are of post-Cambrian age. Basic sills of post-Ordovician but pre-Pennsylvanian (Triticites) age were observed in eastern Peary Land.

Post-glacial marine terraces were measured in a number of localities, and the former distribution of glaciers and ice caps was studied in southern and eastern Peary Land.

Signs of recent volcanic activity were discovered near Brønlund Fjord. A number of small gravel cones, topped by craters with thick deposits of gypsum, sulphur, pyrite, and copiapite,[1] rest upon the dolomites of the Thule group, which have been torn and disrupted, apparently by escaping gasses. The craters are cold, but must be of very recent date, geologically, as the soft copiapite deposits are untouched by wind erosion. Though minute craters with crusts of copiapite occur on the Pleistocene marine terraces, the cones can hardly be referred to as mud volcanoes as most of them rest upon the surface of the non-bituminous eo-Cambrian dolomites.

[1]A basic ferric sulphate.

Photo: J. C. Troelsen

Solfatara, south coast Brønlund Fjord. Light-coloured crust on rim consists of gypsum, copiapite, and sulphur. Independence Fjord in background.

It may be of some significance that the area in question is cut by a number of normal faults.

K. Ellitsgaard Rasmussen, who is now in Peary Land, plans to concentrate his efforts on a petrographic examination of the core of the folded Roosevelt Fjældene, which form the northern peninsula of Peary Land.

Botany (*By Kjeld Holmen*)

From a phytogeographical point of view Peary Land is a high-arctic desert owing to the dryness of the climate. The scarce precipitation and the low humidity of the air during summer are insufficient for plants to exist. Therefore we find vegetation only along the rivers and in the snow-patches.

The vegetation along the rivers consists in the lowland of two types, a *Carex aquatilis*-meadow in moist sandy soil and an *Eriophorum Scheuchzeri*-meadow on wet ground.

In the snow-patches we meet with several types of vegetation: in the wet part there is always an *Eriophorum polystachyum*-bog with *Ranunculus sulphurous* and rich in mosses. On the dry slopes we find *Dryas punctata*-heath with *Carex nardina* or *Kobresia myosuroides*. Between these two types the solifluctional soil results in a rather dry *Salix arctica* vegetation and in somewhat moist soil there is a *Carex misandra* vegetation with *Oxyria digyna* and *Saxifraga oppositifolia*.

In the highlands, that is from 500 to 1000 metres above sea-level, we meet with two types of vegetation. In moist peaty soil there are patches with *Cassiope tetragona*. In dry stony ground there is a "fell-field" vegetation with such plants as *Poa arctica*, *Trisetum spicatum*, *Saxifraga nivalis*, and *S. groenlandica*.

On the east coast of Peary Land the continental plant societies such as the *Dryas*-heath are almost lacking. Instead of these we have types of vegetation dominated by mosses and lichens, especially *Rhacomitrium lanuginosum* and *Cetraria spp.*

The collections brought back from Peary Land comprise about 90 species of vascular plants, 120 mosses, 20 liverworts (no *Sphagna* were recorded), 60 lichens and several other thallophytes.

In the Brønlund Fjord area plant sociological, ecological, and cytological investigations were made during the wintering in 1948-9. The results of this work will be published later in *Meddelelser om Grønland*.

Zoology (*By Palle Johnsen*)

Peary Land is very interesting zoogeographically and had not previously been visited by a zoologist. Endeavours were made to collect as many different species of vertebrates and invertebrates from land, sea, and

fresh water, as possible and some 300 were secured. As would be expected the fauna proved to be very much like the fauna of the east coast of Greenland, though somewhat thinned out; however some species show affinities with the fauna of west Greenland. Practically all the species found represented northernmost records. Many berlese-funnel samples were taken to collect the microfauna of the soil both during the sledge journeys and, in connection with ecological investigations of the biotypes, near the winter station. A thorough study was made of freshwater life, which consisted mainly of midges and crustaceans. For the first time in the Arctic bottom-samples were taken in a large lake at considerable depths. The work in Midsommer Søen showed that the lake was poor in plankton but that the bottom was very rich in midge larvae, even at depths of 50 metres. These larvae must be the main food of the arctic char. In winter the ice-cover on Midsommer Søen reaches some 2.5 metres in thickness.

The greater part of the invertebrates has not yet been determined. An account of most of the invertebrates and of the vertebrates will later be published in *Meddelelser om Grønland*.

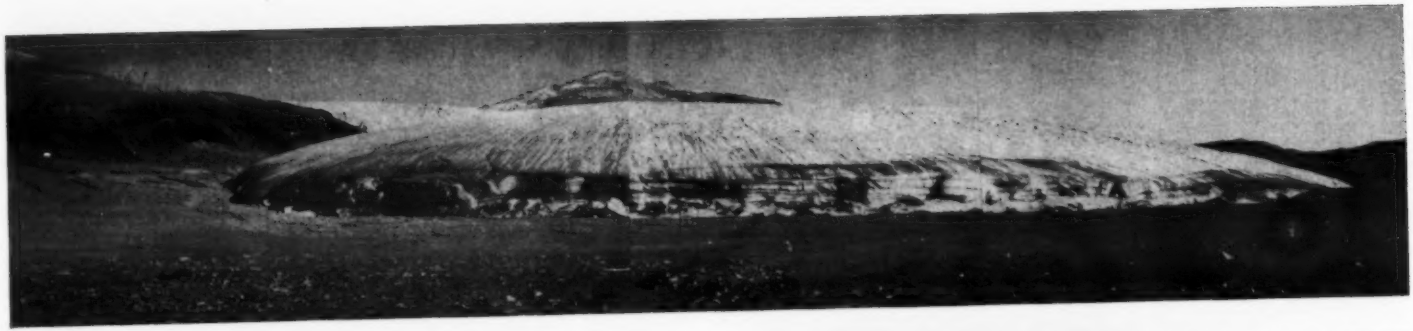
The birds seen during the first wintering were: fulmar, red-throated loon*, brent goose, snow goose, old squaw*, king-eider*, gyrfalcon*, rock ptarmigan*, ringed plover*, turnstone*, sanderling*, knot, dunlin, red phalarope, long tailed jaeger*, glaucous gull*, arctic tern*, snowy owl, redpoll, and snow bunting*. Species marked with an asterisk are known to breed in Peary Land.

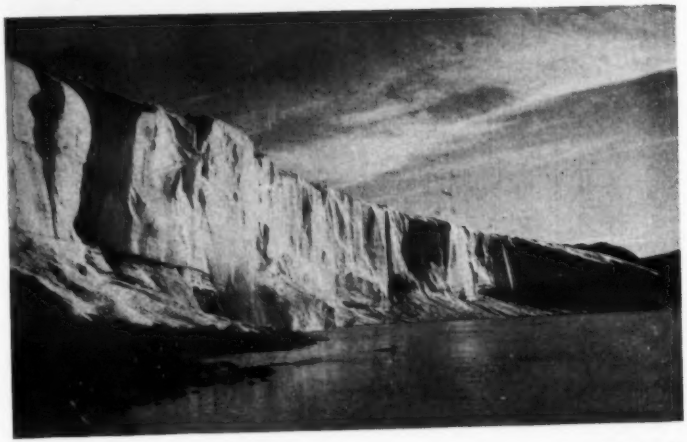
Mammals seen during the first wintering were: hare, lemming, arctic fox, polar bear, weasel, ringed seal, and musk-ox. The polar wolf, which was fairly common during Lauge Koch's visit in 1920, was not seen, nor were any tracks found; it is suggested that the wolf must have become extinct here in recent times as in East Greenland. The abundance of musk-oxen was astonishing, particularly in the Wandel Dal and on Herlufsholm Strand.

Meteorology and Glaciology (*By Børge Fristrup*)

The wintering station at Brønlund Fjord was included in the regular network of Greenland weather stations. Self-recording instruments were used to measure temperature, humidity, pressure, hours of sunshine, and insolation. Readings were made every three hours, and transmitted four times a day. In spite of the comparatively weak radio set the regularity with which these observations were received in Denmark was very satisfactory.

A secondary meteorological station was established on Chr. Erichsen Bræ at a height of about 1,100 metres above sea-level. Self-recording





Photos: B. Fristrup

Glaciers in Etukussuk Dal.

instruments were set up, and during the spring, summer, and fall months complete synoptic observations were made at the same hours as at the main station. In addition numerous meteorological observations were made by Knuth, Holmen, and Fristrup on sledge trips.

The climate of Peary Land is characterized by high winds of gale force in almost all months of the year; a calm is very rare. The temperature range is decidedly continental with a January mean of -32°C. (-26°F.) and a July mean of 6°C. (43°F.). Summer temperatures may be surprisingly high, readings above 15°C. (59°F.) being not uncommon especially in July, which is a frost-free month. The climate is very dry, and the greater part of the precipitation falls as snow in the months of August and September.

Owing to the low precipitation, only 114 mm. annually at 1,100 to 1,200 metres, the snowline lies at about 1,200 metres. Even in winter the land is so sparsely covered with snow that dog-travel is confined to the sea ice and the rivers. The snow is exceptionally dry, and the falling snow frequently resembles a very thin drizzle.

Of the glacier types, the ice cap and the highland glacier are the most common as would be expected from the altitude of the snowline. In the interior around Independence Fjord most of the glaciers belong to one or other of these types, both of which are frequently found in western and northern Peary Land and in eastern Peary Land to the south of Schley Fjord. Chr. Erichsen Bræ is a typical ice cap glacier. Snowbank glaciers are also common in Peary Land; they are generally small, but may reach a considerable size in the upper reaches of the valleys. The glaciers descending from the Inland Ice or from the greater ice caps are another type. Academy and Marie Sophie Bræer at the head of Independence Fjord descend from the Inland Ice, while the two tongue-shaped glaciers in Etukussuk Dal descend from Chr. Erichsen Bræ.

The annual ablation and accumulation were measured by the same methods used by Professor Ahlmann on the Frøya Bræ, Clavering Ø. The annual accumulation along a line across Chr. Erichsen Bræ was found to be 114 mm. of water and the ablation 162 mm. The ablation is therefore considerably higher than the accumulation, and examination of the moraines also showed that Chr. Erichsen Bræ is receding. From the maps of the Danmark Expedition of 1906-8, the Thule Expeditions, and Lauge Koch's Jubilee Expedition of 1920-3 the glaciers at the head of Independence Fjord and the glacier descending into Hagen Fjord appear to have receded and to have shrunk considerably in size. According to marks put up in 1947 the front of Chr. Erichsen Bræ has receded about 35 metres annually since that time. Investigations of the thickness of the layers of ice in a shaft dug in Chr. Erichsen Bræ seem to show that during the time the glacier was formed the annual excess accumulation

Photo: E. Knuth

Tent rings in Brønlund Fjord.

was about three times as great as the present accumulation. Today, Chr. Erichsen Bræ is practically a mass of dead ice, and the rate of movement is insignificant.

A special study was made of the glaciers at the head of Independence Fjord and their rate of movement was measured. The very beautiful tongue-shaped glaciers descending into Etukussuk Dal and the glaciers around Astrup Fjord were among those investigated. Some flights were made over the glaciers for this work.

Archaeology (*By Eigil Knuth*)

The task of the archaeologist during the wintering in Peary Land was to examine the area for Eskimo tent rings and especially for winter dwellings. By such finds it was hoped to throw some light on the Eskimo migration routes. During the brief stay in Peary Land in the summer of 1947, tent rings, shelters, and meat caches were found at several places in the Brønlund Fjord region.

On sledge journeys to Astrup Fjord and Neergaard Elv further tent rings and flint tools such as knives, scrapers, arrow heads, and microliths were found. At Kap Ludovika a winter house and a solid tent foundation were discovered as well as Eskimo meat caches and fox traps. The winter house was later uncovered and measured. It was rectangular in construction and built of large limestone blocks. There was no sign of a passageway and the back walls were several metres high. It is possible that the roof may have been made of skins. The house, as well as the tent founda-

Photo: E. Knuth

Remains of umiak found at Herlufsholm Strand.

tion in the immediate vicinity, seemed similar in type to houses seen in Benton Bugt, Washington Land on the Second Thule Expedition. Several artifacts were found in the ruins of the house such as trace-buckles, a whalebone spoon, and a weapon-head.

On Herlufsholm Strand the remains of a umiak were found on a snow-free terrace. The umiak was made of wood and had whalebone nails.

Until the material has been thoroughly examined it is not possible to say more than that the existence of the Cape Dorset culture has been proved at localities on the south side of Brønlund Fjord and of the Thule culture on the north side of Brønlund Fjord.

* * *

During August 1949 sixteen flights were made to Peary Land, taking in supplies and the new wintering party. Besides the leader, Eigil Knuth, who will remain in Peary Land for a second winter, the party consists of:

Thorkild Nielsen, geographer
Knud Ellitsgaard Rasmussen, geologist
Børge Ib Haagensen, radio operator
Kristen Sørensen, radio operator
Jens Geisler, Greenlander
Tobias Samuelsen, Greenlander

This wintering party will return in 1950, and the object of the Danish Pearyland Expedition will have been fulfilled: the wintering for two consecutive years of a party of scientists in Peary Land, the northernmost country of the world.

Plate 1. Mosquitoes resting on army caps (U.S. and Canadian) at Churchill, in June, 1947.

STUDIES OF THE BIOLOGY AND CONTROL OF BITING FLIES IN NORTHERN CANADA*

***By* C. R. Twinn**

In many areas in the Canadian arctic and subarctic, biting flies, especially mosquitoes (Plate 1) and black flies, are serious pests and interfere greatly with human comfort and activity during the short summer season.

During the past three years, at the request of the Defence Research Board and in cooperation with that organization and other agencies, the Division of Entomology has been involved in an investigation of the biting fly problem in the North, with the object of obtaining more knowledge of the distribution and biology of the species concerned, and of developing practical measures of control and protection.

In this brief presentation it is not possible to deal adequately with the various projects undertaken, and some are not even mentioned, but it may serve to give some idea of the nature and scope of the investigations. The results of the work have been, or are being, presented in more detail in progress reports and in articles published or to be published in scientific journals.

The biological and control aspects of these investigations were commenced at Fort Churchill, Manitoba, in 1947, and continued during 1948

*Contribution No. 2656, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

as a joint project of the Division of Entomology, on behalf of the Defence Research Board, and the Bureau of Entomology and Plant Quarantine, on behalf of the U.S. Army Committee for Insect and Rodent Control.

The United States group was under the leadership of Wm. C. McDuffie and consisted of 4 entomologists in 1947 and 2 in 1948, plus aircrew of a U.S.A.F. C-47 used in spraying tests in 1948, and U.S. Army personnel who assisted in field repellent studies.

In 1949, the work was continued as a solely Canadian effort, and was expanded to include studies in the vicinity of R.C.A.F. establishments in the North West Air Command: at Fort St. John and Fort Nelson, B.C., and Watson Lake and Whitehorse, Y.T. (with headquarters at Whitehorse); and in the Air Transport Command at Goose Bay, Labr. The Canadian personnel who have taken part in the studies during the three years number as follows*: Division of Entomology (1947) 3, (1948) 5, (1949) 13; Division of Botany (1948) 1, (1949) 4; Defence Research Board (1947) 3, (1948) 6, (1949) 9. Many of these were university students, undergraduate and post-graduate, employed on a seasonal basis.

Several university professors also assisted: A. W. A. Brown, Department of Zoology and Applied Biology, University of Western Ontario, gave direction in aircraft spraying experiments; B. Hocking, Department of Entomology, University of Alberta, gave leadership in black fly larvicide tests and assisted in biological studies; F. P. Ide, Department of Zoology, University of Toronto, directed certain phases of the black fly biological studies. In addition, university personnel doing field work on associated projects under D.R.B. grants numbered 3 in 1948 and 4 in 1949. Furthermore, valuable contributions were made in connection with aerial spraying experiments in 1947 and 1949 by members of the staff of the D.R.B. Suffield Experimental Station, and by air and ground crews of the R.C.A.F. The latter service also provided the materials and equipment used in large-scale control experiments in 1949.

Mosquitoes

Churchill is a region of transition from forest (Plate 2) to tundra, and the ground is permanently frozen a short distance beneath the surface. Here 11 species of *Aedes* were found, representative of forest, prairie, and tundra areas, and of the arctic, subarctic, and temperate zones, and also 2 species of *Culiseta*, which are widespread in northern forests. Preliminary studies on most of these species have already been reported (1).[1] Identification of females of certain of the dark-legged species of *Aedes*, which are the major pests in this region, is difficult if not impossible, and

*Exclusive of those engaged in the Northern Insect Survey, which is a project of the Systematic Entomology Unit coordinated by T. N. Freeman.

[1]See references on page 26.

Plate 2. Subarctic forest south of Churchill. Tracked vehicles such as the snowmobile were required to reach biting-fly breeding areas.

in an attempt to solve this problem large numbers of larvae have been reared individually in the insectary, and the last larval exuviae associated with the adults. The immature stages of all the species recorded at Churchill have been found, except *A. spencerii* (Theo.), a few females of which were taken in 1948, and *Culiseta impatiens* (Wlk.), which appears to be rare.

Plate 3. Field study station in a mosquito pool at Churchill, showing cages for individual and mass rearing of mosquitoes.

Field study stations (Plate 3) have been maintained in representative types of breeding areas, and data obtained on species association, succession, abundance, life-histories, and bionomics. Environmental conditions have been recorded such as pH, salinity, colour, temperature, and the macro- and micro-flora of the breeding places. The activities

Plate 4. Lewes River canyon near Whitehorse. Black flies breed in great numbers in the rapids.

of the adults have also been studied at these stations and elsewhere, throughout the mosquito season, including the abundance and succession of species on the wing, and the landing and biting rates as related to temperature, humidity, and light intensity. The studies have also included observations on the mating, feeding, and egg-laying habits of the various species.

At Goose Bay, Labr., in 1949, 15 species of mosquitoes representing 5 genera were identified, and a number of them reared. They included 10 species of *Aedes*, 2 of *Culiseta*, 1 each of *Culex*, *Wyeomyia*, and *Anopheles*. Several of the species are new records for this region. In the North West Air Command region 22 species were reared or collected in 1949, including 17 of *Aedes*, 4 of *Culiseta* and 1 of *Culex*. The data from the biological studies in these areas have not yet been fully evaluated.

Black Flies

The results of studies of black flies at Churchill in 1947 have been published (1). Observations were continued in 1948 and 1949 on species association, and seasonal development, abundance, and activity. The number of species recorded in this region was increased to 16 in 1948, and additional species may have been found in 1949. Several have not yet been described. The major pest species is *Simulium venustum* Say,

which occurs in great numbers from late June to September. It has at least two generations in this region, the emergence dates overlapping.

Twelve species of black flies, the majority of which had not previously been recorded in the region, were found during a preliminary study in the Goose Bay, Labr., area, embracing sixteen rivers, streams, and stream systems. Collections of adults revealed 3 species to be dominant, namely, *Simulium perissum* D. & S. (49 per cent), *S. venustum* (35 per cent), and *Prosimulium hirtipes* Fries (11 per cent). The first adults appeared in mid-June, but heavy infestations did not develop until the latter part of July and continued through August.

Many species were studied and collected at several points in the Yukon (Plate 4) and northern British Columbia in 1949. This material has not yet been completely evaluated, but among the common species are *S. venustum*, *S. arcticum* Mall., and *P. hirtipes*. Several of the species appear to be new to science. Cage emergence studies of black flies in comparable streams at Whitehorse, Y.T., Churchill, Man. (Plate 5), Baker Lake, N.W.T., Goose Bay, Labr., and Algonquin Park, Ont., have produced valuable data on species occurrence, abundance, and life-histories under a wide range of climatic conditions.

Tabanids

Tabanids (variously called bulldog, moose, deer flies, etc.) are very abundant in forested regions of the North, especially in swampy areas. In general, their active season lasts for about six weeks, from the end of June to mid-August, their maximum numbers occurring in July. They do not bite man so readily as do mosquitoes and black flies; nevertheless their large size and persistent aggressive attacks make them extremely annoying and sometimes alarming pests.

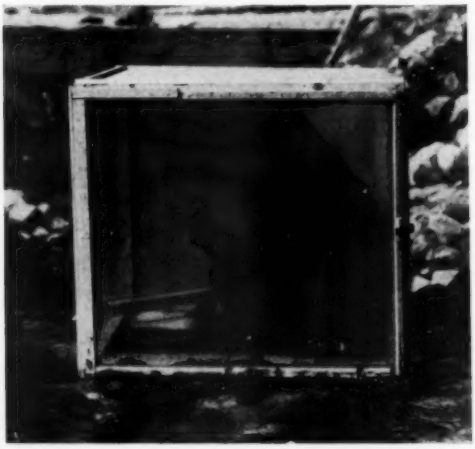


Plate 5. Collecting black flies from cage used in black fly emergence studies in small stream at Churchill.

Seventeen species, including 10 of *Hybomitra*, 5 of *Chrysops*, and 2 of *Atylotus*, have been found at Churchill. In 1949, 17 species were taken at Goose Bay, Labr., including 9 of *Hybomitra*, 1 of *Atylotus*, and 7 of *Chrysops*; specimens taken in northern British Columbia and the Yukon included 13 species of

Plate 6. Experimental spraying by R.C.A.F. Dakota (C-47) to control mosquitoes at Churchill, June, 1947. Luminescent panel on vehicle marks the spray plots.

Hybomitra and 4 of *Chrysops*.

Observations have been made on the succession and relative abundance of the species, their flight, mating, and feeding habits, and the effect of weather conditions on their activities. The immature stages have been studied, particularly at Churchill, where considerable numbers have been reared from the larval stage. *Hybomitra* larvae are carnivorous and cannibalistic and must be reared in isolation. *Chrysops* larvae were found to develop satisfactorily in damp moss rich in organic matter from their natural habitats.

Chemical Control Studies

Mosquito Control

During mosquito larvicide studies at Churchill in 1947 and 1948, about 250 experimental plots, ranging in size from 1000 square feet to 2 acres, were treated by ground spraying equipment with various dosages and formulations of DDT and seven other promising insecticides. Thirteen larger plots, from one-half to 2½ square miles in area, were sprayed by aircraft (Plate 6) with DDT preparations.

The results of these experiments have been published (2, 3). In general, they indicate the superiority of DDT as a mosquito larvicide over other chemicals tested, and show that 0.2 to 0.25 lb. of DDT in oil

solution per acre is a practical dosage to obtain good control of *Aedes* larvae either as a prehatching or as a posthatching application, applied either by ground or by aerial equipment. At lower dosages, emulsions and water suspensions of DDT were somewhat more effective than oil solutions.

Spraying the larvicide on the snow- and ice-covered breeding areas in the spring before the thaw, 2 to 6 weeks before hatching became general, gave results comparable but not superior to conventional larvicide treatments. This practice, however, is advantageous in undertaking

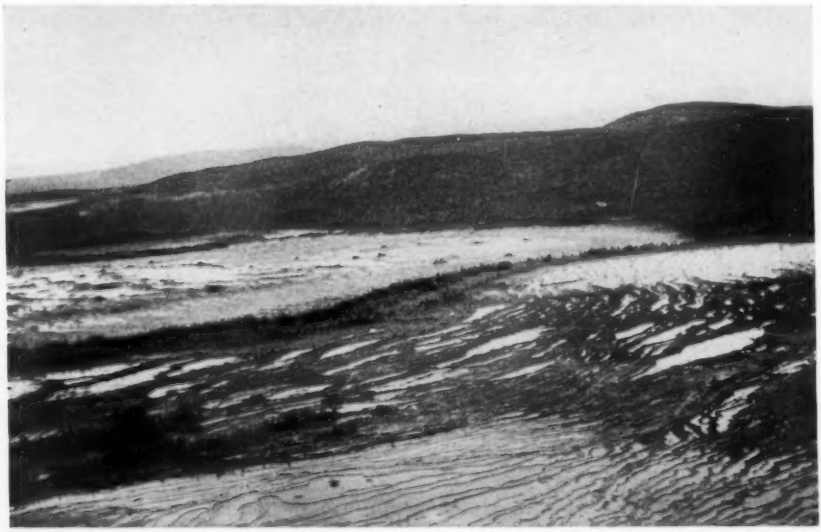


Plate 7. Aerial view of mosquito-breeding sphagnum bog at Goose Bay. Seventeen square miles of these bogs were sprayed with DDT in June, 1949.

ground measures in marshy or swampy terrain, which may be difficult or impossible to traverse after the thaw. It also extends the period during which control measures may be effectively applied.

The period of residual effectiveness of prehatching treatments, at the dosages used at Churchill, is limited. This was demonstrated by the reassessment in June, 1949, of 9 plots, each one-half square mile in area, sprayed by aircraft in the early spring of 1948 with dosages of DDT ranging from 0.05 to 0.35 lb. (average 0.18 lb.) per acre. The data indicated little or no residual larvicidal effect after the lapse of one year. However, there is some indication from small-plot tests that, under certain conditions, heavier treatments of DDT (0.5 to 1.0 lb. per acre) may reduce or prevent breeding the following year.

After the establishment of a satisfactory formulation and dosage, the

effectiveness of aerial spraying in securing protection in limited areas was tested under a variety of conditions. This was made possible by the cooperation of the R.C.A.F. and the Defence Research Board, the spraying being carried out at R.C.A.F. stations at Whitehorse and Watson Lake, Y.T., Fort Nelson and Fort St. John, B.C., Rockcliffe, Ont., and Goose Bay, Labr., (Plate 7), during the spring and summer of 1949. The spray, 4 per cent DDT-fuel oil solution, was applied by R.C.A.F. Dakota (C-47) aircraft fitted with tanks and equipped to release the insecticide by gravity flow through a calibrated vertical emission pipe below the fuselage. The

Plate 8. Collecting mosquito larvae and making biological assessments in infested bogs at Goose Bay.

atomization of the spray was calculated to be 330 microns, mass median diameter, at an air speed of 150 m.p.h.

A total of 43 square miles was sprayed for the control of larvae, and 28 square miles for the control of adults, the dosage used throughout being approximately 0.25 lb. of DDT per acre. Assessments (Plate 8) before and after spraying indicated an average mortality of 91 per cent of larvae in the sprayed areas, and effective control in the vicinity of the R.C.A.F. establishments for periods up to several weeks. This result was undoubtedly influenced in the North West Air Command region by subnormal precipitation in 1949 which produced below-average mosquito populations. Where it subsequently became necessary to spray against the adults, a high degree of control of mosquitoes was obtained which persisted throughout the remainder of the fly season. However, the sprays

were relatively ineffective in reducing populations of adult black flies (Simuliidae), and it is believed that sprays of smaller droplet size would be more effective against these insects.

Chemical assessments of deposits (Plate 9) in the larvicide applications were made by personnel of the Suffield Experimental Station under the direction of H. Hurtig. It was demonstrated that an unusually even and effective distribution of the spray was obtained when the height of the aircraft was adjusted to a height/wind product of 1700. It was also demonstrated that a height/wind product of 800 was not sufficient to

Plate 9. Mosquito-infested swamp at Watson Lake. White cards bearing petri dishes were used to assess spray distribution and DDT deposit.

give a satisfactory distribution and over-lapping of the deposit. Over two plots the aircraft was flown at heights of 600 to 1000 feet to achieve a height/wind product exceeding 2000 under light wind conditions. At these heights the smaller droplets failed to reach the ground because of evaporation of the solvent, and control was spotty and unsatisfactory.

Black Fly Control

The 1947 studies at Churchill of the value of various insecticides in controlling the immature stages of black flies led to the development of an effective formulation and dosage, namely, DDT in fuel oil solution, at a concentration of 0.1 parts per million maintained for 15 minutes at the point of application (4). The effectiveness of this method of treatment has since been demonstrated on a large scale in the South Saskatchewan River (5), in the Lewes River in the Yukon (Plate 4), by further tests at Churchill and Whitehorse, and by observations in streams flowing through large areas sprayed experimentally in mosquito control. Various formulations of other chemicals have been tested, including methoxychlor,

toxaphene, chlordane, gamma-BHC, compounds 497 (dieldrin) and 118 (aldrin), 1, 2, 4 trichlorobenzene, a pyrethrum-piperonyl butoxide mixture, and parathion. With the exception of gamma-BHC, no other compound was found to be so effective, or so satisfactory as DDT. In field experiments none of the materials proved satisfactory as an ovicide or pupicide against black flies.

In 1948, tests were made at Churchill to ascertain possible harmful effects to fish from the use of DDT, BHC, and parathion in black fly-infested streams. Exposures were made at various concentrations for 15 minutes, with pike, northern suckers, lake trout, sticklebacks, arctic grayling fry, and spot-tailed minnows being used as test fishes. The data indicate that at the low dilutions required to control black fly larvae DDT is not harmful to these species of fish. Parathion was even less toxic than DDT. Benzene hexachloride was the most toxic, but caused no mortality to grayling fry at dilutions greater than 1:2,000,000 of gamma-BHC. Sticklebacks and suckers were apparently not affected by even higher concentrations of this insecticide.

The results of the tests with DDT may seem to be contradicted by the fact that large numbers of fish were killed during two experimental treatments of the South Saskatchewan River in 1949. In one treatment the dosage was 0.39 p.p.m. for 24 minutes; and in the other, 0.113 p.p.m. for 16 minutes. However, there was an important difference in the formulations used. In all the successful experiments in which no significant loss of fish was reported, the formulation consisted of 5 or 10 per cent DDT in a mixture of methylated naphthalenes and fuel oil or kerosene, the methylated napthalenes not exceeding 10 per cent. In the 1949 trials in the Saskatchewan River a 30 per cent DDT-methylated naphthalene concentrate was applied without dilution. Unlike the fuel oil or kerosene solutions of DDT, this preparation is heavier than water and has been observed to be carried along below the surface or along the river bottom in droplet form, some of the coarser droplets persisting in depressions for days after the application. Results of analyses of the stomach contents of fish killed by the application suggest that they had been poisoned by swallowing globules of the DDT concentrate. Furthermore, an experiment in the Lewes River at Whitehorse, in which a 35 per cent DDT-methylated naphthalene concentrate was used, demonstrated that in this form the DDT is much less readily available and thus initially less effective as a larvicide than the same dosage of the chemical applied in solution in fuel oil or kerosene. Analyses of water samples from the South Saskatchewan River taken at a depth of 3 feet, 3 miles below the point of application of the 0.39 p.p.m. dosage showed that the DDT content of the water was less than that indicated after the 1948 application of the much smaller dosage of 0.13 p.p.m.

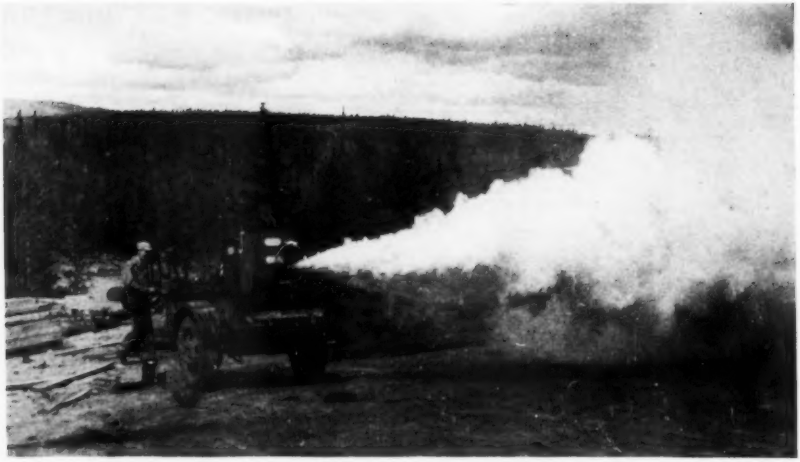


Plate 10. Aerosol generator mounted on vehicle discharging insecticide in control experiments against black flies and mosquitoes at Whitehorse.

Sprays, Aerosols, and Smokes

The effectiveness of ground measures of control against adult mosquitoes and black flies was tested at Churchill in 1947 (6). Fine mist sprays of DDT, pyrethrum, and pyrethrum-DDT aerosols, and smokes containing DDT-nicotine, and BHC proved of little value when applied in 1 to 2 acre plots in open, swampy forest under conditions of extremely heavy and widespread infestation. Temporary reductions were obtained but heavy reinfestation occurred within 15 minutes to 1 hour.

In 1949 a preliminary study of the value of aerosol generators (Plate 10) in controlling adult mosquitoes and black flies in localized areas was commenced at Whitehorse, Y.T. Preliminary results indicated that these machines have definite value when used properly under suitable conditions. Their chief disadvantage appears to be the narrow limit of meteorological conditions on which their use depends; a second is the need of roads to serve as base lines and to allow the operator to take advantage of prevailing winds.

An experiment was also carried out at Whitehorse with smoke generators, the contents of which were reported to have a 6 per cent gamma-BHC content. Two of them, each weighing 20 lb., ignited simultaneously and drawn at 1 to 2 m.p.h. along a frontage of 1200 yards, produced a dense smoke that extended from close to the ground to the tree tops and penetrated the bush to a depth of 1000 yards, covering an area of about 250 acres, and representing a dosage of approximately 0.01 lb. of gamma-BHC per acre. No significant reduction of the infestation resulted, but

Plate 11. Testing biting fly repellents applied to forearms and legs in the forest south of Churchill.

complaints were received of the strong and pungent odour of the insecticide.

Repellents

In 1947 and 1948, at Churchill, a selection of promising repellent materials supplied by the Orlando, Fla., laboratory of the U.S. Bureau of Entomology and Plant Quarantine, were evaluated in field tests for effectiveness as skin treatments against mosquitoes and black flies (Plate 11). The so-called standard repellents, dimethyl phthalate, Rutgers 612, and 6:2:2 mixture, gave average protection times of 5 to 6 hours against mosquitoes. The most effective repellent was propyl *N*, *N*-dipropylsuccinamate, which gave an average protection time of 6¾ hours (to the first bite). Most of the repellents tested gave longer protection against black flies than against mosquitoes, but none appeared to be very effective against tabanids (moose and deer flies). It was concluded that none of the new repellents were sufficiently superior to warrant their adoption in place of the present standard materials.

In 1948, 30 repellents were tested as stocking impregnations against mosquitoes to compare their relative resistance to rinsing, wearing, and outdoor aging. One, impregnated at 3 grams per square foot, withstood 8 to 9 rinsings, and 2 others were almost as good; none showed outstanding stability in the wearing tests, the best being effective for only 30 to 40 hours of wear; none appeared capable of withstanding more than 1 week of outdoor exposure.

Tests in 1947 of wide-mesh headnets (¼ in. mesh) impregnated with dimethyl phthalate showed that they provided good protection against moderate infestations of mosquitoes, but were readily penetrated by black flies. The standard U.S. Army fine-mesh headnet proved the most effective against these pests.

Other Investigations

The important subject of biological control has not been neglected, and from time to time, as opportunity offered, observations have been recorded on the presence, identity, and activities of the natural enemies found attacking biting flies in their various life stages. With a view to expediting the investigation of this phase of the biting fly problem, a special project was set up to deal with it, and preliminary studies were carried out at Churchill in 1949 under the leadership of H. G. James, of the Dominion Parasite Laboratory, Belleville, Ont.

Other cooperative studies that are going forward assisted by Defence Research Board grants to universities include the following: determination of mammal and bird hosts of biting flies by precipitin tests, and of plant hosts by means of radioactive isotopes (A. S. West, Queen's University); the fundamental nature of attraction and repellency as affecting biting flies (A. W. A. Brown, University of Western Ontario); determination of the possible value of orally administered repellents (A. A. Kingscote, Ontario Veterinary College); black fly emergence studies (F. P. Ide, University of Toronto); flight range studies of biting flies (B. Hocking, University of Alberta); the psychological effects of biting fly attack (D. C. Williams, University of Manitoba); and the nature of insect toxins and the possibility of immunization (Queen's University).

References

(1) Twinn, C. R., B. Hocking, Wm. C. McDuffie and H. F. Cross. "A preliminary account of the biting flies at Churchill, Manitoba". *Can. J. Research*, D, 26 (1948) pp. 334-357.

(2) McDuffie, Wm. C., H. F. Cross, C. R. Twinn, A. W. A. Brown and C. N. Husman. "The effectiveness of DDT and other insecticides as larvicides against arctic species of *Aedes*". *Mosquito News*, 9 (1949) pp. 145-149.

(3) McDuffie, Wm. C., J. F. Sharp, H. F. Cross, C. R. Twinn and D. M. Wilson. "The effectiveness of prehatching treatments for the control of arctic mosquitoes". *Mosquito News*, 9 (1949) pp. 51-56.

(4) Hocking, B., C. R. Twinn and Wm. C. McDuffie. "A preliminary evaluation of some insecticides against immature stages of black flies (Diptera: Simuliidae)". *Sci. Agr.* 29 (1949) pp. 69-80.

(5) Arnason, A. P., A. W. A. Brown, F. J. H. Fredeen, W. W. Hopewell, and J. G. Rempel. "Experiments in the control of *Simulium arcticum* Malloch by means of DDT in the Saskatchewan River". *Sci. Agr.* 29 (1949) pp. 527-537.

(6) Goldsmith, J. B., C. N. Husman, A. W. A. Brown and J. F. Sharp. "Exploratory studies on the control of adult mosquitoes and black flies with DDT under arctic conditions". *Mosquito News* 9 (1949) pp. 93-97.

Photo: Alaska Native Service

Roundup of the Golovin herd, 1949.

THE REINDEER INDUSTRY IN ALASKA

***By* Margaret Lantis**

FEBRUARY 1916 at Igloo in the region of Nome was a hopeful time. Eskimo owners of reindeer herds and apprentice herders had come here from all northwest Alaska to attend a Reindeer Fair. This was not the first Reindeer Fair sponsored by the U.S. Bureau of Education. But that year the Fair was much more impressive, with representatives of ten villages competing in many contests: fastest sled deer, strongest deer, best trained deer for driving, most skilful lassoer who could catch and break a bull to drive most quickly, herdsman who could butcher and dress a carcass cleanest and fastest, and sledlashing for the trail. There were other contests: composing a song about reindeer, shooting with bow and arrow and with rifle, snowshoe racing, and other sports. Sleds, harness, clothing also were judged.[1] The competitive emphasis on skill, the showing-off of fur clothing and other fine homemade possessions, the resourcefulness displayed in long travel by reindeer sled across strange country to reach Igloo—all fitted into the Eskimo system of individual prestige. These Reindeer Fairs are a symbol of the high point in satisfaction obtained from Eskimo ownership of reindeer.

However, elements of the anticlimax were already present. In 1914, a white family had formed a company for commercial development of

[1]Forrest, 291-296 (see references p. 44).

reindeer, beginning a new and very troubled period in the reindeer industry. The first period, in which only Eskimo and Lapps owned deer in Alaska, had begun in 1892 when domestic reindeer were first imported to Alaska from Siberia. The second period, that of commercial exploitation, extended from 1914 to 1939. In the latter year, the Federal Govern-

ment bought all non-native-owned reindeer. The third period, since 1939, has been one of slow recovery from the chaotic conditions in the '30's. While it is unlikely that Congress will change the rules of ownership, various people periodically think they can develop a profitable new industry. To indicate the actual prospects, we review the history and present status of Alaska's reindeer.

Dr. Sheldon Jackson, first Superintendent of Education in Alaska,

was worried by the depletion of whales, walrus, and other food resources of the Eskimo, resulting from the 19th century's uncontrolled hunt for oil, whalebone, and ivory. To provide a supplementary source of food and skins, he imported 1280 domestic reindeer in the period 1892-1902.[2] Funds were supplied by Congressional appropriation and small contributions of private groups. The deer were introduced at Teller, on Seward Peninsula west of Nome, and from there distributed westward to Cape Prince of Wales at Bering Strait and to St. Lawrence Island, southeastward to Golovin, Unalakleet, and still farther to the Kuskokwim River. Later they were taken to the Pacific shores: Kodiak, Umnak, and Atka Islands. Quite early they were distributed northward to Kotzebue, Point Hope, Wainwright, and Point Barrow. The original Teller–Nome–Golovin area later became the breeding range for quarrels as well as reindeer.

Meanwhile, in the 1890's several church missions had an official connection with the Bureau of Education by which their missionaries were employed also as teachers in the Federal school system. Reindeer, therefore, were entrusted to these mission schools, of eight different denominations, as well as to the first secular schools, for the teachers' general supervision of herds and herders in the following system: individual Eskimo were loaned 100 reindeer on their agreement to care for them, train apprentices, and repay at the end of five years the number of animals borrowed, keeping their increase. For his pay as a herder, the Government gave an apprentice a specified small number of deer and an amount of supplies annually for four years, and allowed two months' attendance in school each year. This last usually was not achieved, though. When his herd numbered 100, he took an apprentice himself; when 150, another apprentice, and so on, until he had four. Those Eskimo receiving the original loans of deer had been specially trained by Lapps at Teller. By their exploits on long deer drives, they became some of the most famous Eskimo in the history of Alaska.

The Nome Gold Rush brought a new demand for meat, and the price of reindeer meat doubled. With the Whites thereupon showing considerable interest in reindeer ownership and with the missions quite unsure of their ownership rights, it became necessary to adopt strong regulations in 1907. The most important clause was that, "No female deer shall be sold or otherwise disposed of to any person other than a resident native of Alaska."[3] Old, barren, or disabled does were killed and reported to

[2]Some reports give the number 1296, although 1280 is the more frequently cited figure.

[3]The term "natives of Alaska" was generally understood to mean "the native Indians, Eskimos, and Aleuts of whole or part blood inhabiting Alaska at the time of the Treaty of Cession of Alaska to the United States and their descendants of whole or part blood, together with the Indians and Eskimos who, since the year 1867 and prior to the enactment hereof, have migrated into Alaska from the Dominion of Canada, and their descendants of the whole or part blood," as worded in later legislation. Senate Subcommittee Hearings, p. 20,351.

the superintendent. Surplus males could be slaughtered, the meat and hides sold to anyone, thus yielding income.

Ownership was not so simple as it might appear, however. In the winter of 1897-98, to provide relief for some gold miners supposedly faced with starvation, a herd of reindeer (for meat and driving, not breeding stock) and 113 people, 77 of whom were Lapps, were brought from Norway. These families expected to be permanent settlers, unlike the few Lapps who had been brought in 1894 to instruct the Eskimo and then return to Europe. Six men took the deer up toward the Yukon on the relief expedition, all others going on to the north Bering Sea.[4] Although all were promised reindeer, fortunately some decamped for the gold creeks. Finally eight men were loaned 100 deer each and assigned to missions to instruct Eskimo dependents of the missions, the deer being part payment for services. In 1909, ownership of deer was reported as follows: Lapp instructors 14 per cent, missions 22 per cent, U.S. Government 23 per cent, Eskimo herders and apprentices 41 per cent.[5] In other words, all but 14 per cent were for the Eskimo's use. By 1914, ownership had changed somewhat, yet not to the detriment of the Eskimo; in a total of 57,872 deer, the Government held 7 per cent, missions 12 per cent, Lapps 17 per cent, and Eskimo 64 percent.[6]

Even though most herds contained fewer than 2000 deer each, until about 1916, the necessary number of earmarks for identification had increased confusingly. A single herd would contain Government reindeer (from original import and repaid loans, held for use of the villages in case of famine) or deer still assigned to the missions for loan and relief although the latter were no longer part of the school system, plus animals belonging to individual Eskimo and Lapps. It was not easy to determine ownership from the slices, swallow-tailed cuts, and other marks on the ears. And no other system has even yet been found satisfactory, such as hot-iron branding—the reindeer coat is much too heavy, the skin is too thin—or metal tags on the ears.

This was only one of the many difficulties, most of which still must be surmounted. Reindeer herding is difficult in many different ways. In the early period, the European system of "close herding" was used with good results. This means staying with the herd *all the time*, through blizzard, spring thaw, summer mosquitoes, through Christmas holiday, whaling, sealing, and attendant festivities on the coast. It is, moreover, herding in some of the world's worst country for overland travel, for example, in the Kuskokwim Valley.

[4]See Senate Subcommittee Hearings, p. 20,347 for Laplanders' names and their agreement (in part) with the Government.

[5]Ibid, p. 20,061.

[6]Ibid, p. 20,179. By 1938 the Reindeer Service reported that Whites owned 33 per cent, "a rather ominous trend", p. 20,358.

Here are the most important discouragements:

1. Most Alaskan Eskimo are, in a deep fundamental way, a shore-dwelling people, their culture adapted to hunting on the sea. Even many who lived inland most of the year liked to be on the coast at special times. The revolution in their way of life required by herding a semi-domesticated animal was difficult and disturbing. For such skilled hunters, herding is boring, confining, and its rewards too far in the future, as the author of 'Daylight moon' has said.[7] Anticipation of the kill keeps the hunter going through the tedious effort of sitting attentively by a seal-hole or waiting beside a flaw in the ice. He anticipates also the fresh seal, his basic food, and muktuk (whale-skin), his favourite delicacy. When the salmon or herring are running in east Bering Sea or when the walrus come north along the coast of the Arctic Ocean, it is asking a lot of the Eskimo to expect him to disregard family, village, and old habits in order to plod along after half-wild reindeer.

The Eskimo were not forced by anyone to take up reindeer herding; but economic need, encouragement by many of the early teachers, and especially the sincerity, enthusiasm, and personal efforts of W. T. Lopp, Walter C. Shields, and a few other officials sustained their wavering interest. Also, probably most important of all, some Eskimo were gaining wealth and prestige by means of their herds.

2. As the herds grew, they required even more protection. Wolves, lynx, and other predators were constantly attacking the deer. As many as 60 deer have been killed in one night, it has been reported.

3. When the herds increased and spread inland, they encountered the American caribou on their great migrations. Being closely related, reindeer are often carried off by caribou migrations unless there is very watchful herding.

4. As the herds spread and mingled, it was harder to keep account of them. However, until large-scale commercial herding developed, a fawn was "marked to its mother" and the difficulty was not insurmountable.

5. The problem of long-term forage was developing on Seward Peninsula where the deer had been first introduced. The lichens, so-called reindeer moss, on which the deer feed in winter are brought back very slowly when once depleted. The Reindeer Service and the Fish and Wildlife Service have found that it requires twenty-five years or more to replenish thoroughly depleted lichens.[8]

6. Finally, there were the parasites: the bot-fly whose larvae infest the nose of the reindeer, weakening them, almost maddening them, and the warble-fly whose larvae burrow through the skin, decreasing the

[7]Forrest, p. 46.

[8]The 1945 report by Lawrence J. Palmer, then Range Examiner, gives a gloomy prognosis. See "The Alaska tundra and its use by reindeer," 1945, pp. 12-13.

commercial value of the hide. These also can be combatted by care in moving the herd from an infested range.

To fight all the reindeer's enemies, close herding is needed, herding by experienced men who know reindeer ways, local geography, and condition of ranges. They must know how to live on the trails of the arctic interior for weeks at a time. They must know selection, corralling, butchering, tallies, accounts, and all the other tasks of livestock raising. A good reindeer man deserves admiration and assistance.

Three developments in the next period, however, discouraged the Eskimo and weakened their new interest in herding: formation of reindeer associations, inauguration of a policy of "open herding," and impingement on their range by White-owned herds, especially those of the Lomen companies. The reindeer were allowed to run in large herds, managed by corporations—or rather, their boards or councils—each owner being credited with a percentage of the herd. Livestock specialists of the Biological Survey (now Fish and Wildlife Service), thinking of cattle ranges in the Western states, encouraged free ranging of the deer, i.e. open herding. But reindeer are not cattle. First, they are not so thoroughly domesticated and they react more like sheep. Second, their tundra and mountain country is much more difficult to travel in locating and rounding up the deer. Third, having to find their own forage during the long hard winters, the deer are likely to be weakened and need protection in the spring at fawning time. Above all, fourth, they are in danger of mingling with wild animals like themselves, as if the pioneers on the U.S. frontier had tried to herd half-domesticated bison, without fences, when the great bison migrations moved north and south on the high plains.

The associations or native corporations, unfortunately, were too much like some of those on Indian Reservations in the States. When the whole group owned the herd, no single individuals took the responsibilities of ownership. And without system or facilities for marketing meat, they could not get money to hire herders. In this period, 1914 to 1939, some of the superintendents were not strong leaders, did not understand the business, or did not have sufficient conviction of its value. Moreover, a $4,000,000 private business in reindeer had developed, with the inevitable politics of large enterprises.

Between 1914 and 1921, Carl J. Lomen, of a politically prominent Nome family, bought 8,693 reindeer from two missions and from the Lapps.[9] He paid $18 and $20 a head for most of them. Although the sellers thought they had the right to sell, the legality of these purchases remained questionable, since no female deer could be sold to non-natives.

[9]Statement by Mrs. Carl J. Lomen. Senate Subcommittee Hearings, p. 20,071.

(Small herds were acquired by other Whites subsequently.) The purchases never were tested in the courts, however. The Lomen herds were grazed on public domain along with the others.

The Lomen reindeer business grew with tangled luxuriance. Companies were formed and dissolved. Relations of subsidiary companies to parent companies never were clarified. The original capitalization of $750,000 in 1914 came to be more than $2,000,000 by 1930 (with alleged assets of $4,785,000) although no one actually knew how many reindeer were owned by the Lomen interests. By 1924, the Lomen family claimed 40,000 deer from their original 8,700, despite shipments to the States, 1916-20 inclusive, of 436,650 pounds of meat, representing 4,000 animals or more. (Figures not given for other years.[10]) While 40,000 was not impossible, the claims became almost fantastic after 1924. After the last thorough roundup in 1923, everyone connected with the industry, including Government representatives, based estimates of probable increase on the known birthrate of reindeer without adequately estimating losses. In 1932, the Alaska Reindeer Supervisor estimated 374,160 deer in 51 herds for native use.[11] With the additional 250,000 claimed at the time by the Lomens and the herds of a few other White men, there still could not have been more than 700,000.[12] Yet throughout the 1930's Alaskans talked about 1,000,000 to 1,500,000 head of reindeer.[13]

Carl Lomen undoubtedly was deeply interested in reindeer intellectually and emotionally as well as financially. He not only bought refrigerator ships, built four abattoirs, many corrals and other facilities, he also wrote articles and organized committees to publicize the fine qualities of reindeer meat. But unfortunately the Northwestern Livestock Corporation was a too pretentious front for the straying reindeer and grumbling Eskimo.

Even with goodwill from both Eskimo and Whites, there still would have been misunderstandings in the situation existing in the late 1920's and early 1930's. Casual marking of mavericks and fawns with the Lomen mark, despite the range rule that mavericks were to be marked to the herd in which found, and a few cases of pirating by Lomen herders made the Eskimo suspicious, especially when the Corporation began calling itself co-owner of any herd in which its deer happened to be running. The Lomens may not have been responsible for acts by their herders, but the mere fact that several hundreds and even thousands of company rein-

[10]Financial review from an article by Trumbull White, "Coming storm over Alaska" (*New Outlook*, August 1933) included in Senate Subcommittee Hearings, pp. 20,060-20,066.

[11]Anderson and Eells, p. 197. Of these 51 herds, 43 were held by, or for, Eskimo.

[12]For the number of deer owned by Whites in 1936, see Senate Subcommittee Hearings, pp. 20,343-5. In 1938, the Reindeer Service estimated a total of 600,000 reindeer in Alaska, having counted 175,000 in 1937, including native and non-native ownership (p. 20,358). Of the 175,000, 33 per cent belonged to White individuals and companies.

[13]Ibid, pp. 20,126 and 20,131.

deer were feeding on the ranges of the Eskimo's deer engendered resentment.

In 1931, apparently working closely with the company, the Reindeer Service issued complicated new range rules. These allocated a percentage of the annual increase of animals for each local co-owner of a herd and a smaller percentage for owners of strays from other herds. Moreover, these percentages varied according to the total percentage of increase each year, entailing still more figuring of the number of adult females and fawns. When, by such allocation and marking, an owner was "over" or "short," he was debited or credited reindeer. One can imagine sorting and marking fawns, tallying accurately, figuring percentages, in the terrific hurly-burly and noise of corralling several thousand terrified deer, often in bad weather. Naturally, the ear-marking never was accurate, resulting in overs or shorts for every owner from year to year until the Eskimo owner did not know what he had. With large numbers of reindeer of so many owners running together, with fawns separated from their mothers, and with so many adult strays, some such scheme for crediting animals to owners had to be used. It is doubtful, though, whether the rules ever were accurately translated into the Eskimo language in all interested villages so that the older men could understand.

The company, over-capitalized, had to press hard against resources in order to squeeze out profit. In favour of the company it should be said that marketing of reindeer meat in large quantity—at its best—is very expensive and difficult. The following difficulties must be met today, and most were present 25 years ago.

1. There are no docks anywhere along Bering Sea or the Arctic Ocean where the herds are located, hence there are lighterage charges to transport carcasses from shore to ship and equipment from ship to shore. Furthermore, the equipment is expensive by the time it reaches Alaska.[14]

2. Freight charges of the few ships with refrigerator space are high.

3. Ships can reach such places as Kotzebue and Deering for a very limited season and usually come on short notice when the weather happens to be good, making it difficult for herd owner or manager to know when and how many animals to butcher, especially if he does not have much cold-storage space.

4. Although at a few fields, cargo aircraft now can be used profitably, most village sites still cannot accommodate large enough aircraft for shipping the bulky carcasses in profitable quantity. In the days of the Northwestern Livestock Corporation, there were, of course, no large

[14]Lighterage is an especially serious problem at Mekoryuk, Nunivak Island, where the only reindeer abattoir in Alaska is now located. Ships anchor five miles, or more, offshore. The Nunivak Development Project (the slaughterhouse project) tow-barge was lost in a storm in 1946. A power barge was then obtained.

cargo aircraft.[15]

5. Public demands regarding meat condition are more rigorous than they were twenty-five years ago when the business first boomed commercially. Deer can no longer be butchered on the beach and fresh carcasses loaded on the ship to be refrigerated en route. Now they must be hung (bled) and cleaned properly, cooled, frozen and stored in deep-freeze, and sacked in stockinette or, as some of the Eskimo say, the deer must have their underwear when they go travelling.[16]

6. The best markets for luxury meats are in New York and other cities of the Eastern states, requiring another 3,000 miles of freight charges.

7. Some states prohibit sale of reindeer meat, classifying it as game. V. Stefansson has claimed that the tremendous livestock interests of the Western states were responsible for this and other restrictive measures.

8. There is no steady market, as most Americans prefer beef no matter how good the reindeer meat may be.

After several Government investigations and probably considerable loss of money, the Lomen companies offered to sell to the Government. Finally, in 1939, $750,000 was authorized for purchase of deer, abattoirs, and other equipment from forty owners: individuals (including Lapps), missions, and companies. When the reindeer at last were counted with fair accuracy, the Lomens were found to have only 87,000 deer, of which 14,000 to 15,000 were on Nunivak Island.

Very few condemnation suits were brought. Most owners sold to the Government willingly, at prices ranging from $3 a head for most herds to $11 for the good herd on Nunivak. Average payment per head was $3.74. Total expenditure was less than the appropriation. This was the kind of clean sweep of a tattered problem that Government agencies periodically long for.

The Reindeer Service had been given to the Alaska Native Service in 1937 to try to rehabilitate the ailing industry for the benefit of the Eskimo.[17] The A.N.S. was handicapped at first by personnel without adequate knowledge and judgment for handling either reindeer herds or Eskimo communities and by continuation of most of the old difficulties. Then there were two new factors: the defence program bringing unusually high wages, enticing men from both herding and hunting; and the demand for fawnskins for military parkas, resulting in slaughter of does and fawns.

[15]Refrigerator power-barges are the most promising means of transporting meat on the Yukon and Kuskokwim Rivers and elsewhere in west Alaska.

[16]The Eskimo preferred to have internal bleeding, to save all the blood, which they were accustomed to eat. They also had to learn to select animals for prime meat rather than for colour of coat, which mattered to them in making parkas. Forrest, p. 45.

[17]In 1931 the Federal schools were transferred from the Office of Education to the Bureau of Indian Affairs, which operates in Alaska through the Alaska Native Service.

There may have been poor herd management, too, and some unnecessary slaughter beyond military requirements. But reorganization has been effected as follows:

A housecleaning in personnel.

Reinstitution of constant ("close") herding except on the islands, where there are no wolves and the reindeer cannot get away.

A new program to get herds from the old corporations (associations) into the hands of individual Eskimo who are then personally responsible for the deer.

Examination and allocation of ranges by a range specialist.

Institution of a program of predator control.

Abandonment of the old slaughterhouses, located in areas of poor forage and straying herds, and construction of a slaughterhouse on Nunivak Island, which began to operate in 1945 and shipped 13,000 carcasses in three seasons (1945, 1946, 1947).

Development of a market for hides—the skin makes good gloves—and fawnskin jackets, fur boots and other fur articles.

In addition, the U.S. Public Health Service has included reindeer and caribou in its research on parasites of Alaskan animals. A veterinary-pathologist, working at a Ladd Field laboratory (Fairbanks), has examined tissues for Echinococcus, which causes a growth in the lung. In 1949 two doctors visited Nunivak Island to make a specific study of parasites of reindeer. Results of these studies are not yet available.

In the summer of 1948, a special survey of reindeer north of the Kuskokwim River was made by a biologist of the U.S. Fish and Wildlife Service and the director and assistant director of the Native Resources section of the Alaska Native Service. Twenty localities with reindeer interests were visited, many summer and winter ranges were examined, and seventeen herds were reported on in detail.

Eskimo when asked what they thought caused the decrease in reindeer listed wolves, starvation, poor herding and management, excessive butchering, and mixing with caribou. Whites cited wolves, poor herding and management, starvation due to wolves scattering and chasing. The survey party's listing of losses in each herd shows that wolves caused serious damage to seven herds and straying to seven, not necessarily the same ones. Wolves were unusually numerous from 1946 to 1949 inclusive.

To control them, poisoned bait has been dropped from aircraft onto the ridges at 3,000 to 4,000 feet elevation. It is claimed that the doses are not harmful to caribou and mountain sheep (apparently because in a form that these animals do not eat) and are placed in areas unfrequented by dog-teams. After the bait has been dropped in the winter, the predator-control agent mushes through the area in the spring to check on results. In the winter of 1948-49, the Chandalar region of northern Alaska and the area from the Big Toklat River to Big Delta were baited, chiefly for

the protection of caribou. During the preceding three years, important reindeer areas covered were Seward Peninsula and the Noatak region. Although difficult to evaluate precisely, this program is said to be effective.

Regardless of other incentives, bush pilots, herders, trappers, and others kill wolves to get the bounty. The Shungnak herd owner, for example, reported that wolves caused a known loss of 75 animals in a herd of about 770 deer during the winter and spring of 1947-48 despite his trapping of eight wolves that winter. The killing of four wolves around the Hooper Bay herd in the winter of 1947-48 stopped molestation that season, but there already had been a reported loss of 107 head from a herd numbering fewer than 600.

Forage problems are not so serious for the new generation of reindeer men, trained regarding range condition and herd management, who can usually find adequate winter range in their home areas if they are careful in shifting their animals. According to the 1948 report, out of thirteen herds, ten had access to good winter grazing. The winter range of the other three was "questionable," "fair," and "overgrazed." Although it has been claimed that reindeer will burrow down through deep snow to get at the lichens, in reality they seem uninclined to flounder through deep snow but will keep to the higher land blown relatively clear. While it is true in some cases that it is the herders who are most anxious to stay on higher ground (and near the villages), such a tendency does not explain the condition on Nunivak Island, for instance, where the deer are not herded in winter. Though they have parasites, the Nunivak animals have been large, healthy, and not beset by wolves or the temptations of wandering off with caribou.[18] Yet in winters of heavy snow, the loss from starvation is much greater than in normal years. The explanation is that the more accessible ranges where the deer tend to go of their own accord are overgrazed.

Now that young Eskimo have other interests besides hunting, the new loan program is more attractive and functions better. An Eskimo—nearly half of the borrowers are Second World War veterans—is loaned a minimum of 500 deer to be repaid in five years. For efficient herding, a man is encouraged to take 1,000 head. A borrower also receives supplies for the first year, in return accepting supervision and training. In this system, a man has a strong interest in protecting his herd. For example, whereas in 1947 migrating caribou carried away three herds of Govern-

[18]Caribou bulls introduced into the Nunivak herds largely account for the greater size. By personal checking of weights, I found that most carcasses of adult animals shipped from the Island in 1946 weighed between 90 and 130 lbs. dressed (heavier than north Alaskan reindeer) and not a few were between 150 and 175 lbs. Nunivak animals also have had good conformation and good meat. The Nunivak herds, which may have numbered 18,000 or more in 1940 (officially counted 15,000), grew from 98 reindeer brought in in 1920 and 10 caribou bulls brought in in 1925.

ment reindeer, an alert and capable owner in the Kotzebue area managed to get his herd into the corral before the caribou came by. This man now has 3,000 head from his original loan of 1,000, which he is repaying to the A.N.S.

Herds in the winter of 1947-48 were located as follows:

Government ownership and management: 7 (Kotzebue, Hooper Bay, Nunivak Island, Alitak on Kodiak Island, Umnak Island, Atka Island, Pribilof Islands).

Eskimo corporations: 7 (Wainwright, Point Hope, Noatak, Buckland, St. Lawrence Island, Teller, interior of Seward Peninsula).

Individual Eskimo owners from the original system of ownership: 3 (2 at Barrow, one at Wainwright).

On loan to individual Eskimo under the new system: 11 (3 at Barrow, 2 at Kotzebue, one each at Selawik, Shungnak, Deering, Golovin, St. Michael, Bethel).

In the summer of 1949, the Reindeer Service record was as follows:

SIZE AND DISTRIBUTION OF REINDEER HERDS, 1949

Type of Ownership	*Location*	*Number of Head*
Association (corporation)	Wainwright	270
	St. Lawrence Island	450
		720
Government	Escholtz Bay (Kotzebue)	3,500
	St. Michael (including former Egavik herd)	150
	Hooper Bay	400
	Nunivak Island	4,500
	Atka Island	1,700
	Umnak Island	1,400
	Pribilof Islands	700
		12,350
Individual	Barrow	750
	Barrow	1,600
	Barrow	650
	Kotzebue	1,500
	Kotzebue	1,500
	Shungnak	400
	Selawik	1,500
	Noatak (new herd from Escholtz Bay)	1,100
	Wainwright	450
	Golovin	1,500
	Igloo (Seward Peninsula)	750
	Candle	650
	Alitak (Kodiak Island)	2,500
		14,850
	Grand Total	27,920

Comparison of the two lists shows that while most Association herds have been dissipated or were loaned to individuals because Association

management was inadequate, the individual owners have held their herds quite well. (Many are still technically borrowers, not having fully repaid their loans, but are classified as owners.)

Even though the care of most herds has improved, the record is not uniformly cheering.

> The Kivalina-Noatak (Association) herd, on loan, by 1948 had decreased to only about 100 head, too small to pay its way, hence was returned by the borrower and, without attention, by the summer of 1949 had strayed.
>
> Another remnant of an Association herd, the Point Hope, numbering 327 deer in July 1947, similarly was returned. A herder was hired, but when he left the deer for a short while to get supplies, the remaining 250 animals disappeared (1948).
>
> At Hooper Bay, the Government herd deteriorated and suffered serious losses, chiefly because the community was not interested. Here, it was true that the Eskimo had tried to hold the herd near the village, where ranges were depleted. A loss of 600 reindeer in one year could not be explained adequately. The herd was down to 500 animals by the summer of 1948 and 400 by 1949.
>
> The Bethel herd, not mentioned in recent reports, apparently has strayed.
>
> Two or three Seward Peninsula herds mentioned in 1947 are not identifiable in the 1949 list. There has been shifting, combining, and renaming of herds rather than total loss. Deering is now included in the Candle herd, for example.
>
> In 1946 and 1947, the Wainwright Association herd lost about a thousand reindeer by straying.
>
> The Escholtz (Government) herd, which was started in 1941 with 4,500 reindeer from the old Lomen herds, suffered a loss—chiefly by straying—of 1,500 head the first winter on its new range in the Kotzebue area, but has held together well since 1942. From it have come several good herds now under private Eskimo management. It should not, therefore, be classed among the losses.

The heaviest loss in the past two years has occurred on Nunivak Island. In 1949, plans to operate the slaughtering plant were cancelled at the last moment, when an aerial survey revealed an unexpected decrease of animals. Causes of the loss (parasites, range depletion, etc.) are being investigated. Local Eskimo earned about $15,000 at this plant in 1946. They received most of the $20,000 cost of operation in 1947, for which they cannot find an adequate substitute in other sources of cash income. In 1948, when there was also no slaughtering for shipment, Nunivak men who went away to work in fish canneries earned not more than $6,000, and other earnings were very small. Because Alaska institutions and households need the meat and the isolated Nunivakers need the wage work, strong efforts will be made to bring the Nunivak herds back to a size that will permit "commercial" slaughtering. It may require ten years or more for the winter forage to recover. It is planned, therefore, to move some animals to the mainland if possible (but this is difficult) or to slaughter

1,500 or whatever number is necessary to hold the herd down to 3,000 head.

Part of the meat of the 3,000 carcasses shipped from Nunivak Island in 1947 was divided, as in previous years, among boarding schools and hospitals administered by the A.N.S. and the remainder sold in Alaska towns, in Seattle and New York to pay costs of abattoir and cold storage.[19] This was a useful enterprise, showing that Alaska has a place for one such plant.

Photo: Alaska Native Service

Roundup of the Golovin herd, 1949.

Among the individually-owned herds those in northwest Alaska that have prospered and look most promising are the three at Barrow, the two at Kotzebue, and one each at Selawik and Golovin, as reported in the 1948 Reindeer Survey. Others probably will be successful, but have not been maintained as separate herds long enough or have suffered seasons of bad luck. The following quotations, which are typical of the individually-owned herds, show why there is hope for some of these herds.

[19]There is no luxury quality in Alaska marketing of reindeer meat, as there is in U.S. marketing. Towns like Nome and Bethel have a steady market for both meat and skins. In such western communities, not served by highway or railroad, reindeer meat can compete easily with meat shipped from the States, not infrequently brought from Anchorage by expensive air freight.

Golovin: "Government herd, totalling 500 head, which was loaned to S——— in 1946. The herd when handled in August 1948 totalled 1,177 head including a fawn increase of 56% on adult females, or about 31% on the total herd.

"The herd is well situated with summer range on Rocky Point and winter range in the vicinity of White Mountain. A brief survey of the White Mountain area indicated adequate lichen forage. . . . There has been some molestation from wolves during the past year on the winter range but none on the summer range. The rate of increase indicated this herd is well managed and in a good thrifty condition.

"This herd has a good market outlet at White Mountain and is only a short distance by air freight from the Nome market. There is also a limited local market. . . .

". . . . . this herd is supporting one family and furnishing employment to two or three additional helpers during fawning, roundups and other extra work periods."

Barrow: "This herd was started in 1946 when H— borrowed 300 reindeer from the Northern Frontier Association. It is now estimated to number about 600 head. The herd is cared for by one family with the additional help of two herders hired for the winter season; however, H— has a supplemental income from work at the Meade River Coal Mine. This permits him to meet herd expenses without excessive butchering.

"The summer range is along the Arctic coast from Dease Inlet to Point Barrow while the winter range is inland along the west side of Meade River and about 80 miles back from Peard Bay. Fawning range is in the vicinity of the Meade River Coal Mine. Summer range appears adequate . . . H— reported that his winter range was good and that it is far enough back from the coast so that no icing occurs." There have been virtually no losses from wolves or caribou.

"There is a ready market at Barrow Village and Point Barrow for all the reindeer products this herd can supply. During the past year, 70 carcasses have been sold for meat.

"Side lights which have a bearing on the welfare of this herd include some illegal slaughter by both Whites and Natives."

For small herds, involving the sale of perhaps only 20 or 30 carcasses at a time, air freight is adequate, and for local hauls, not too expensive. When White men come in expecting to make a big business of the reindeer, they must ship many hundreds or thousands of carcasses and must have, therefore, modern refrigerator ships, abattoirs and other facilities, which are all very expensive. Surprisingly, the dream of commercial reindeer breeding has died reluctantly.

In 1945, two White men at Nome organized Santa Claus, Inc., to take a few reindeer to the United States for exhibition in the Christmas shopping season. One of the men was Dewey Anderson, a former associate of the Lomens, and the other an employee of the A.N.S., released in 1946 and later returned to the States. By special permission of the Secretary of the Interior in accordance with present regulations, they

bought a few deer, including females, from an Eskimo at Golovin. When some of the deer were lost, they tried to make the seller supply others. When this failed, next year they tried to get a herd owner at Kotzebue to sell, again without success.

In 1947 when Dewey Anderson was a Representative from Nome to the Alaska Legislature, that legislative body sent a Memorial to the U.S. Congress demanding that "immediate steps be taken to repeal existing laws whereby Whites are restricted from owning reindeer." Fortunately, no one paid much attention to the Memorial.

The Eskimo's interest in the reindeer business both before 1920 (at the time of the Reindeer Fairs) and since the Second World War suggests that they might by now have had many thriving herds if there had not been the commercial interlude. Since it did occur, the only way to judge the possibilities of this as a native industry is to give the Eskimo a chance for about a generation. Because the Second World War occurred immediately after the Whites' herds were bought and the Eskimo were given an opportunity to start over again (1939), the latter have been operating in a reasonably normal way only since 1946. The most important factor, demonstrated repeatedly, is good herd management. By constant attention of trained reindeer men, the herds can be protected from their enemies, with of course occasional seasons of unavoidable losses. It takes time, though, to develop the necessary knowledge and develop the herd itself so that it yields sufficient profit for a strong incentive.

There is good evidence that, even with proper care, there never will be the 4,000,000 head of reindeer that V. Stefansson postulated as feasible, basing his figures on U.S. Department of Agriculture estimates of possible range load in Alaska.[20] If inhabitants of north and west Alaska did nothing but tend reindeer, a total of one million or perhaps two million head might be achieved. Modern trends are against this, however. For example, Clarence J. Rhode, a regional director of the U.S. Fish and Wildlife Service, said in 1949, after an aerial survey, that only nine sizeable herds of caribou (2,500 head or more) remained in Alaska. These were located in the Colville River, Chandalar, Steese, Point Hope, Kobuk-Noatak, Upper Koyukuk, McKinley Park-Minchumina, Netchina and Alaska Peninsula areas, with small scattered herds elsewhere. The recent decrease in caribou was attributed to improved weapons and means of transportation, now added to the natural hazards. With more and more Whites entering Alaska, most of whom are not interested in herding reindeer, and with relatively fewer and fewer Eskimo, it becomes extremely difficult to protect either caribou or reindeer. Since a herd to be manageable and also profitable should have not more than 3,500 and not less than 1,000 head, with about 2,000

[20]Stefansson, V., "The Arctic in fact and fable," pp. 81-2.

as a good number, there would have to be 500 such herds to make a total of even 1,000,000 animals. In west and north Alaska, including Eskimo, Indian, Aleut, and White towns and villages, there are not 500 communities with herds or likely to be sufficiently interested to support even one local herd. There might be, of course, five herds to supply a community like Kotzebue and none in four or five other localities. If the herds are well managed, however, they will increase at such a rate that one can serve the area now supplied meat by several.

There appear to be natural limits on reindeer increase, not yet clearly understood. On islands like Atka where there have been no predators and where there has not been excessive slaughtering, the herd, nevertheless, has not increased for several years and seems to have reached its natural limit. The explanation may be continued dominance by over-age bulls, or some unknown factor. Until more is known about such biological controls and until the trend of economic development and the pattern of settlement are clear, it seems unrealistic to predicate such things as marketing facilities and reindeer associations on great natural increase and a big industry.

After twenty years of chaos, reindeer management is reviving soundly. The Alaska Native Service and its subsidiary, the Reindeer Service, have been honest in admitting losses and in trying to find their causes. Now that they have the difficult task of picking up the pieces of a broken industry, they—like the Eskimo—should be given an unharried period in which to work with the Eskimo in their modern development.

Conclusions and Recommendations:

1. A loan herd should be large enough to encourage the borrower to try to make most or all of his living from it; otherwise, he is tempted to abandon the herd. It should contain, therefore, 500 to 1,000 head.

2. The borrower should also receive the first year a cash grant to stake him until he can obtain cash income from sale of animals. While the loan of deer must be repaid in animals, the cash can be repaid in deer or in time and experience given in training and supporting apprentice herders.

3. A reindeer herd, whether Government or individually-owned, must be kept small enough to be guarded carefully and to prevent range depletion. The Alaska Native Service recommends 2,000 head. Probably 3,000 are not too many. When herds grow larger, they should be split and taken to different winter ranges if it is not feasible to slaughter the excess immediately.

4. All borrowers must agree to accept livestock-management supervision, especially on such matters as percentage of fawns and old bulls to

be killed, percentage of animals to be castrated, and methods of corralling and slaughtering. The supervisors, on their part, must travel extensively with the herds. This is not an office job but one requiring first-hand knowledge of each herd.

5. "Close herding," that is, constant herding, is strongly recommended.

6. Government herds, with adequately-paid chief herders, are necessary to maintain reserve stock for loans, emergencies, experimentation, and for training herders. In Alaska, four such herds would be the minimum requirement, one for each of the major western regions of the Territory.

7. Although community or association or corporation reindeer herds might be feasible in Canada, they have not turned out well in Alaska, hence are not recommended.

8. Steady supply of local markets is recommended in preference to large-scale periodic supply of distant markets in larger population centres. The large investment in equipment necessary for the latter is a hazardous risk. Also, transportation facilities in the Arctic have not yet developed sufficiently to assure marketing economically and at seasons to take advantage of favourable price, shortage of competing meats, and other market factors.

9. The aircraft and the refrigerator power-barge or other shallow-draft vessel are best suited to local transport of meat. Their cost, therefore, must be figured in any reindeer business.

10. It is recommended that the reindeer business be kept for the native people for the next fifteen or twenty years.

References

"Alaska [including Reindeer]", Hearings before a Subcommittee of the Committee on Indian Affairs, U.S. Senate, 74th Congress, 2nd Session, Pt. 36, 1939.

Anderson, H. D., and W. C. Eells, 'Alaska natives', Stanford University Press, 1935.

Andrews, C. L., 'History of Alaska', 1932.

'The Eskimo and his reindeer in Alaska', 1939.

Forrest, E. C., 'Daylight moon', 1937.

Johnshoy, J. W., 'Apaurak in Alaska; social pioneering among the Eskimos'. (Translated and compiled from the records of Rev. T. L. Brevig, 1944.)

Lopp, W. T., 'White Sox: the story of the reindeer in Alaska', 1924.

Palmer, L. J., "Improved reindeer handling", *Circular* No. 82, U.S. Dept. of Agriculture, Nov. 1929. Reprinted in Senate Subcommittee Hearings (see above), pp. 20,311-20,322.

"The Alaska tundra and its use by reindeer", Office of Indian Affairs, U.S. Dept. of the Interior, 1945. (Mimeo.).

Rouse, C. H., C. R. Mountjoy, and D. M. Belcher, "Reindeer Survey—1948", Fish and Wildlife Service and Alaska Native Service, U.S. Dept. of the Interior, 1948. (Mimeo.).

Scott, R. F., E. F. Chatelain, and W. A. Elkins, "The status of the Dall sheep and caribou in Alaska", Transactions Fifteenth North American Wildlife Conference, 1950.

Stefansson, V., "The Arctic in fact and fable", *Headline Series*, No. 51, Foreign Policy Ass., March-April 1945.

Reports and personal communications from the Reindeer Service, of the Alaska Native Service.

(See also Bibliography in 'The Eskimo and his reindeer in Alaska'.)

Yellow arnicas and ferns near Cape Lambton, Banks Island.

A BIOLOGICAL EXPLORATION OF BANKS AND VICTORIA ISLANDS*

By **A. E. Porsild**
National Museum of Canada

A WELCOME opportunity to carry out a much needed reconnaissance of the flora of Victoria and Banks Islands presented itself last spring when Dr. A. L. Washburn, Executive Director of the Arctic Institute, extended an invitation to the National Museum and the Geographical Bureau to join in a summer's field season in Banks and Victoria Islands. Dr. Washburn intended to continue his geological work in Victoria Island[1] and, if time permitted, to carry out some preliminary work in Banks Island. He had already completed arrangements with Canadian Pacific Airways to charter a Norseman aircraft which was to be piloted by the veteran northern flyer, Ernie Boffa, who had had considerable flying experience over Victoria and Banks Islands.

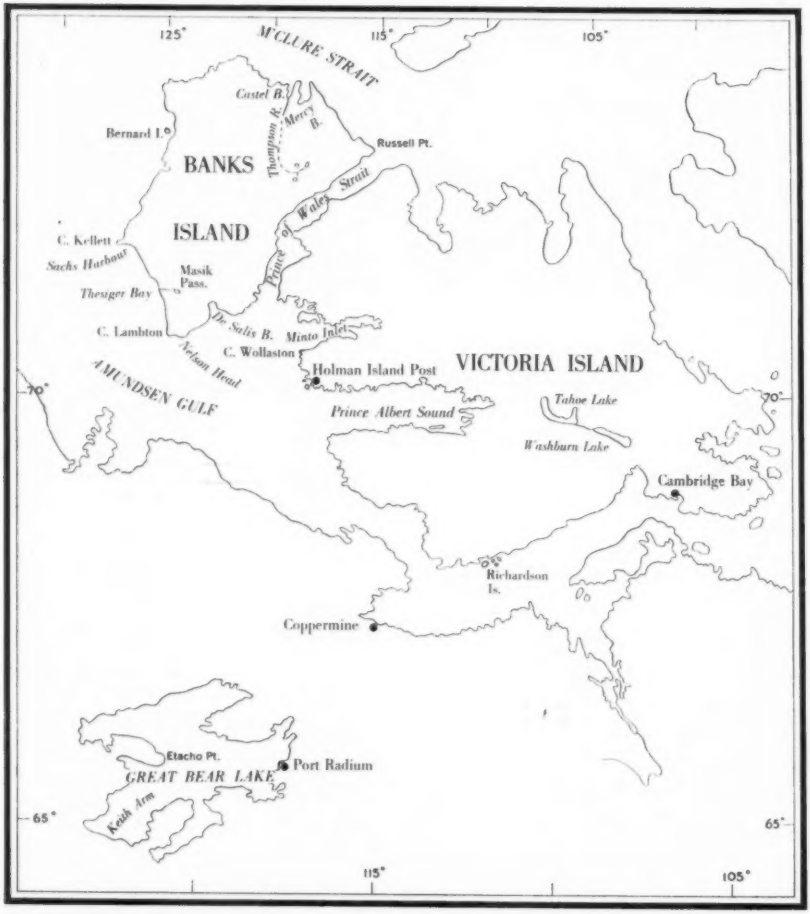
Dr. Washburn had originally planned to commence this season's work at Cambridge Bay in May. When quarantine followed the influenza epidemic there, he chose Holman Island Post instead where Ernie Boffa landed him and Mrs. Washburn at the end of May. It was on the return from this flight that Ernie Boffa had a forced landing some fifty miles north

*Reprinted from the *Arctic Circular* 3 (1950) pp. 2-9.

[1]See: Washburn in *Geol. Soc. Amer.* Mem. 22, 1947.

of Coppermine when his aircraft became a total wreck. Fortunately, owing to expert handling, neither Ernie Boffa nor his mechanic was hurt, and both were rescued a few days later as the result of a most successful R.C.A.F. search directed by W/C D. R. Miller.

Accompanied by Mr. J. L. Jenness of the Geographical Bureau I left Ottawa on July 5 for The Pas, Manitoba, in an R.C.A.F. Canso piloted by



F/O Cuthbertson, which was taking north a magnetic survey party headed by Ralph Hutchison of the Dominion Observatory. At The Pas we transferred to an R.C.A.F. Dakota, which landed us at Yellowknife on July 7.

At Yellowknife we received the discouraging news that the season north of Great Slave Lake was unusually late; reports from Holman Island

Post even indicated that it would not be possible for an aircraft on floats to land there until the end of the month, or fully two weeks later than anticipated.

The delay afforded a long hoped for opportunity to visit the Scented Grass Hills—the 2,100-foot high peninsula, which separates the two westernmost arms of Great Bear Lake. In late August 1928, at the conclusion of six months of exploration on Great Bear Lake, my brother Robert and I had made a brief visit to Etacho Point. Lack of time, and a brewing storm without safe anchorage for our boat, permitted only a hurried ascent. However, the botanical discoveries we had made strongly suggested that the summit of the peninsula might have escaped glaciation, or at least that its upper levels might have stood above the latest advances of the ice, acting as a refuge for a number of plants not known to occur elsewhere in the area.

The ice on Great Bear Lake was still unbroken but Ernie Boffa believed that he might find enough open shore water, or a suitable lake, where he could land us with our equipment. Accordingly we left Yellowknife on July 9, stopping over at Port Radium to pick up some supplies and a light canoe. Crossing the lake, we circled the Scented Grass Hills. The hills are dotted with small lakes, a few of them large enough for a small aircraft to land on, but all were still ice-covered. Along the south shore of the peninsula was a narrow lead, where Ernie Boffa managed to land us, eight miles west of Etacho Point.

Except for one day when the ice moved out from the shore, Keith Arm remained choked with ice during the next two weeks. Jenness and I spent this time making a botanical survey of the limited area which we could reach on foot. On July 20 Ernie Boffa returned and succeeded in landing us on a lake near the summit of the peninsula. A few hours on the ground convinced me that, although there was abundant evidence of glaciation, the composition of the flora strongly supported my earlier contention that the plateau might have escaped the last advances of the ice and have remained a nunatak refuge for a group of plants otherwise of Cordilleran range.

After returning to Radium we learned that Holman Island Radio now reported open water on the lakes near the post and on the 25th we were able to resume our journey. Arriving at Holman Island Post on the 28th we were warmly greeted by Link and Tahoe Washburn, and by the Hudson's Bay Company's Post manager, Bill Calder who, with Father Buliard of the Roman Catholic Mission, and a few Eskimo families, made up the entire population. Most of the natives of the district were at their sealing camps at Minto Inlet and elsewhere. Even Father Buliard was at the time living at his sealing camp ten miles up the coast, where he had

200 large seals temporarily buried in the sand of the beach. In this manner the seals keep tolerably well preserved.

Although the sea was still icebound, as far as we could see from the air, summer appeared to be at its height in the Holman Island area and the landscape, which from the air had appeared rocky and barren, on closer inspection was ablaze with colour. In full bloom on the hillsides back of the Post were masses of creamy-white mountain avens, purple loco weeds, and magnificent yellow cinquefoils. On south-facing slopes we

Cliffs at southern end of Thesiger Bay, Banks Island.

could even find miniature "rock gardens", all gay with purple gentians, daisies, and Lapland rhododendrons, yellow arnicas, and in rock crevices even three kinds of rock ferns.

With the season so far advanced time was at a premium. Fortunately, two weeks of exceptionally fine weather followed, and together with the continuous daylight made it possible to do a good deal of flying. Our first excursion took us to southern Banks Island. Crossing from Cape Wollaston to De Salis Bay we saw open leads far to the south. Southern Banks Island looked quite summerly with scarcely any snow left on the land and most of the lakes free of ice. Flying through Masik Pass we saw open water in Beaufort Sea as far north as Cape Kellett. After a brief landing at Sachs Harbour on the west coast we continued along Thesiger Bay. To the south of this bay the coast is spectacular with perpendicular cliffs rising sheer from the sea to heights of 1500 feet. We landed on a

small lagoon to inspect the trap-sedimentary sequence which characterizes the cliffs. On the south-facing talus, below a cliff where a colony of herring gulls and a pair of peregrine falcons nested in apparent harmony, we found a lush vegetation in part composed of plants that had not been recorded from Banks Island.

A second flight from Holman Post took us first to the head of Minto Inlet, thence south to the head of Prince Albert Sound and east by way of Tahoe and Washburn Lakes to Cambridge Bay. The return trip was

Esker at head of Minto Inlet, Victoria Island.

by way of the south coast as far as Richardson Island from where we crossed to Prince Albert Sound, thence north and west back to Holman Island Post along the strike of the probable contact between the trap-sedimentary sequence of the Holman Island area and the sedimentary rocks to the south-east.

The weather thus far had been good; but with the long overdue breaking-up of the sea ice we entered upon a period of unsettled weather with frequent fogs and overcast. During the remainder of the month, Dr. Washburn continued his study of geomorphological problems in western parts of Victoria Island while, on August 10, Jenness and I set up an advance base on a small, unnamed lake in northeastern Banks Island, about thirty miles west of Russell Point. After landing us there Ernie Boffa returned to Holman Island Post for a load of gasoline. Bad weather prevented his immediate return and not until the 21st were we able to set

out on a flight to the northwest and north coasts. During the preceding ten days northerly wind had prevailed causing a low overcast over the northern part of the island. Poking his way through this overcast, with occasional landings when the visibility became too low, Ernie Boffa got us through to the west coast on the 22nd, landing on the south shore of Bernard Island, which lies off the combined deltas of two large rivers. From 2,500 feet up Beaufort Sea appeared to be clear of ice as far north as Bernard Island, from where the edge of unbroken polar ice stretched in a northwesterly direction. After a brief stop we followed the coast north but we soon encountered dense fog again which forced us a considerable distance inland. Through the broken undercast we looked down on a plateau of sedimentary rocks cut by a complex system of broad canyons and river valleys that now carried very little water. In many of the canyon walls we saw fine exposures of well stratified sedimentary rocks, and in one place a thick, black band which might have been coal. Unfortunately, the absence of large lakes prevented landings, so we were unable to examine this interesting landscape more closely. Flying along the southern edge of the overcast, Ernie Boffa at last picked up Thompson River which he was able to follow to Castel Bay on the north coast. Castel Bay, as well as the nearby Mercy Bay, was open as were narrow leads along the south shore of McClure Strait while to the north the strait itself appeared unbroken.

We landed at the foot of Mercy Bay abreast of a conical hill which is a prominent landmark, approximately 500 feet in height. The lateness of the day and the threatening fog, which was slowly creeping in from the Polar Ice pack, made it inadvisable to remain here long enough to explore the foot of the bay for remains of McClure's winter quarters of 1851-2 and 1852-3 where his ship, the *Investigator*, was abandoned, later to be broken up by Eskimo. On the beach I picked up bits of flotsam that undoubtedly were from the *Investigator*. The surface of the wood was bleached white, but scraping revealed one piece to be English oak and another to be mahogany; both were perfectly fresh and sound after nearly a hundred years on the beach. Climbing the hill to the east we could not but wonder how many times McClure and his men, during the two years they were frozen in here, had climbed this identical hill to look toward the Polar Sea that never opened enough to release their ship. In the steep cliffs facing the bay we found beautifully preserved fossil corals in beds of Devonian rocks.

On the return flight to our base camp west of Russell Point we ventured a short distance out over the Polar Ice for a glimpse of the high and forbidding cliffs which, between Russell Point and Mercy Bay, where we crossed the coastline, rose sheerly to heights approximating 600 feet. In deep river canyons cut to sea-level were fine exposures of well stratified

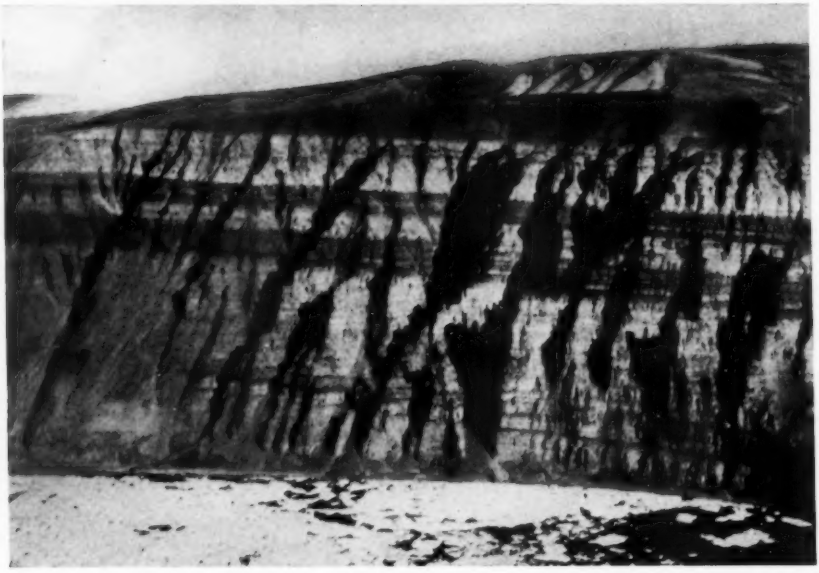
sedimentary rocks. Similar exposures were subsequently examined in the canyon walls near the mouth of a small river which flows into Prince of Wales Strait, approximately thirty miles south of Russell Point. Fossils obtained there, and at Mercy Bay, have been identified as Devonian by Dr. Alice Wilson.

During the last few days the weather had been distinctly autumnal but the following day the temperature dropped to 26°F. with a blizzard from the North which covered the ground with snow and put an end to

Nelson Head, Banks Island.

further collecting of plants. So backward had the season been in northern Banks Island that only half a dozen species of plants had succeeded in maturing seeds, while the majority were overtaken by winter when their flowers had only just opened.

Breaking camp on the 24th we spent the next two days in the southern part of the island, where landings were made at De Salis Bay, Nelson Head, and on a small mountain lake near the summit of the 2,400-foot high plateau which forms the southern portion of the island south of Masik Pass. From Nelson Head west to Cape Lambton and thence north the coast over a distance of about forty miles is formed by sheer cliffs rising from the sea to heights varying from 500 to 1500 feet. The cliffs are formed of well stratified sedimentary rocks and are capped by a great thickness of trap. Flying in perfect weather along this cliff we obtained



Trap-sedimentary series, Cape Lambton, Banks Island.

some very fine photographs of this most spectacular part of Banks Island.

Back of the cliffs the plateau is everywhere covered by a thick mantle of angular rock debris weathered *in situ* which completely covers the underlying bedrock; this suggests that the plateau was not overridden by the glaciers which covered the middle part of the island. However, a small esker which forms the very summit of the plateau shows that at any rate a local ice cap once rested here.

North of Masik Pass the centre of Banks Island is occupied by rolling hills which probably nowhere exceed an altitude of 1000 feet. Toward the north end of the island the north and south trending watershed approaches to within eight miles of the east coast. The eastern portion of the hills has undoubtedly been glaciated and submerged at least to the 500- to 600-foot level. Flying over this part of the island I was forcibly reminded of a huge tidal flat from which the sea has just recently receded. More than half of the surface is lake-covered and lacks well-defined drainage patterns. Here, as everywhere on Banks Island, the land surface bears abundant marks of frost action, either in the form of solifluction stripes or of soil polygons. The latter are such a characteristic feature in the landscape that in the course of the summer we jokingly came to refer to Banks Island as "Polygonia".

The northernmost part of the island is somewhat higher than the middle part and may reach altitudes of nearly 1500 feet. This highland may have escaped glaciation; from the air, there appeared to be no pronounced glacial deposits such as eskers or moraines; furthermore, the rivers which empty into McClure Strait have eroded deep canyons that extend

Victoria Island: typical low coastal plateau, west of Holman Island, showing solifluction contouring.

at least fifty miles inland. Neither at Mercy Bay nor at a lake where we landed near the southwestern edge of the highland, approximately fifty miles southwest of Castel Bay, did I see evidence of glaciation. Likewise, the presence, on the west coast of Banks Island, of high cliffs which contain fossil ice such as is common on the unglaciated north coast of Alaska and in the Yukon, may indicate that the north coast, and possibly also the west coast of Banks Island, was never glaciated.

Owing to difficulty of access by sea, Banks and Victoria Islands have until lately been among the least known islands in the Canadian Arctic Archipelago. No professional botanist had previously visited these islands and for floristic information we had largely depended upon the collections of plants made by officers of the early British expeditions under McClure and Collinson. It was not surprising, therefore, that in the first two hours of botanizing in Banks Island I doubled the known number of species of vascular plants. Although we made landings in ten different places in Banks Island and in eleven places in Victoria Island, in only one or two did time permit long enough stops for thorough collecting of plants. Nevertheless, at the end of the season the total number of vascular plants known to occur in Banks Island had been increased from 65 to 174 and that of Victoria Island from 106 to 201 species. Although the total number of species is low, a relatively large percentage is endemic to the Canadian Arctic Archipelago, a fact which suggests long isolation. Contrary to expectation the flora of both islands proves phytogeographically to be more closely related to the Cordillera than to the flora of Alaska and the Northern Yukon.

As already stated the summer of 1949 was climatically an unusually backward one in the Western Arctic; the break-up occurred almost three weeks later than normal and not until late August did the first boat get in to Cambridge Bay.

Animal life, naturally, was greatly affected by the late season and many migratory birds that normally breed in Banks and Victoria Islands either did not reach their nesting grounds or failed to breed. Throughout the summer we saw very few small land or shore birds and some of those we did see obviously had not bred. All summer we saw only one brood of rock ptarmigan and one flock of 28 black brant. We did see a number of yellow-billed and red-throated loons but they, too, had reared no young. In fact, the only breeding land birds that were at all common were falcons and rough-legged hawks. But even those had experienced hard times, for a pair of gyrfalcons which had nested on a cliff at Mercy Bay had raised but one young and this, when almost full-grown, had starved to death below the nest. On August 5 the nest of a pair of peregrine falcons south of Washburn Lake contained 4 unhatched eggs.

Judging from the abundance of their burrows, lemmings formerly had been abundant on both Banks and Victoria Islands; last summer they were very scarce. On Banks Island we saw collared lemmings in one place only, on a strand flat twenty miles south of Russell Point. On Victoria Island, although generally speaking very scarce, they were reported to be increasing in the vicinity of Cambridge Bay. Foxes, too, were very scarce and only a few tracks were seen. In a letter written just before Christmas, Bill Calder reports that only ten foxes had been traded at Holman Island Post and that the outlook was very poor. Wolves and arctic hares were seen on a number of occasions; caribou appeared to be relatively plentiful and fresh tracks were seen everywhere; in late August scattered small herds, composed mostly of does with their fawns, were seen in the northern part of Banks Island. Although we kept a sharp look-out for musk-ox, we did not actually see any. However, a few may still exist on the island for we saw tracks of a small number at Mercy Bay. When crossing Amundsen Gulf on August 25, we saw a large bowhead whale which obligingly remained surfaced while we circled low over the perfectly calm sea.

Although much too short for the work on hand the field season of 1949 had been a profitable and most enjoyable one for all of us. This was very largely due to the splendid and enthusiastic collaboration by all members of the party, not least from our pilot, Ernie Boffa, and his mechanic, Glenn McKinnon, who maintained the keenest interest in the work of all members of the party, and in the face of the multifarious demands made upon them in the interest of geology, geography, and botany, remained ever unperturbed and helpful.

SOME NOTES ON THE SOVIET ARCTIC DURING THE PAST DECADE

By **William Mandel**

AT THE start of the Second World War, the Third 5-Year Plan was in operation in the U.S.S.R. In the Soviet Arctic the major aim of this plan was to make the Northern Sea Route a regular shipping route for the four months of the year during which navigation is practicable. Since 1938, partly as a result of the four great Stalin Class icebreakers, laid down during the Second Plan, which now came into operation, partly as a result of other improvements in shipping facilities, such as better ice-forecasting and design of suitable freighters, no ship, as far as is known, has had to winter in the Soviet Arctic.

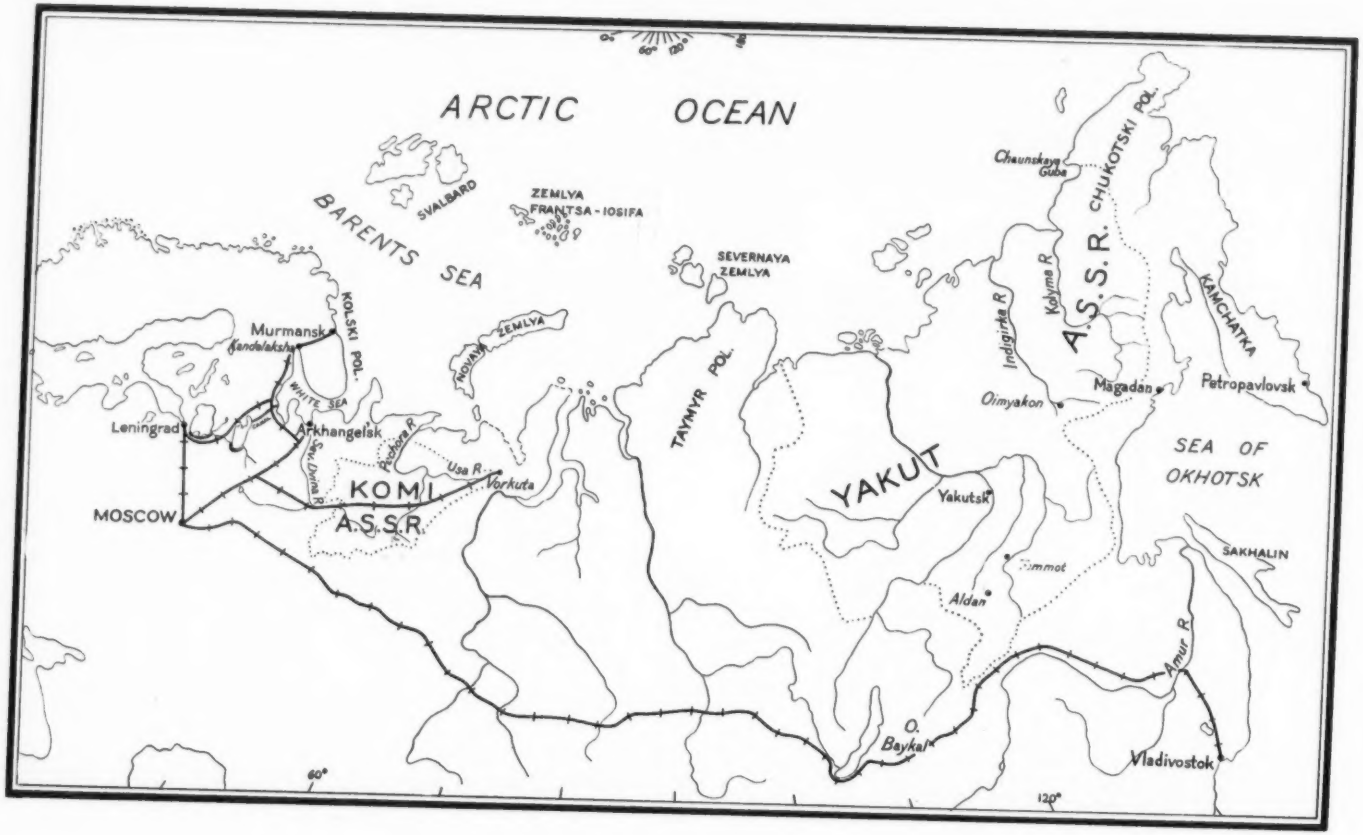
The Second World War, as might be expected, caused both destruction and stimulated effort in the Soviet Arctic.[1] The Kol'ski Poluostrov (Kola Peninsula) was the scene of two large-scale military campaigns involving forces of more than 100,000 men on each side: a German offensive in the summer of 1941, and a Soviet offensive in October 1944. The temperature during these campaigns was hardly arctic: it was reported never to have dropped below 19°F. during the Soviet offensive, and to have risen as high as 49°F. But the terrain of the Kol'ski Poluostrov battles was typically arctic and the fighting occurred at the difficult period between the thaw and the freeze-up.[2] In fact much lower temperatures were experienced in the winter campaigns around Leningrad during the Soviet-Finnish fighting of 1939-40, around Moscow and Leningrad in 1941-2, and around Stalingrad in 1942-3.

In spite of heavy damage to the Murmansk railway by German bombing it was never put out of action. Murmansk, itself, suffered greater damage from air attack than any other city in the Soviet Union except Stalingrad. But under the energetic command of Ivan Papanin, head of the Northern Sea Route Administration, facilities for receiving Allied supplies at this port were continuously expanded. The freight-handling capacity of Arkhangel'sk[3] was also increased and, nearby, the new port of Molotovsk was greatly enlarged. The Murmansk and the Arkhangel'sk railroads had been built under the last Tsar, but double

[1]Chernenko, M., and T. Selyavina, editors, 'Polyarniki v Otechestvennoi Voine', Glavsevmorput', Moscow, 1945, p. 258.

[2]Sidorov, V. I., 'Razgrom Nemtsev na Severe', OGIZ, Moscow, 1945; K. Simonov, 'On the Petsamo Road', Foreign Languages Publishing House, Moscow, 1942; I. S. Isakov, 'Voenno-Morskoi Flot SSR v Otechestvennoi Voine', OGIZ, Moscow, 1944; *Information Bulletin*, Embassy of the U.S.S.R., Washington, 1944, Oct. 31, Nov. 16, 18, 21, Dec. 9; *Pravda*, 1944, Oct. 16, 25-29, Nov. 2.

[3]*White Sea Pilot*, British Admiralty, London, 1946; *Christian Science Monitor*, 19 Nov. 1941; *New York Times*, 3 Dec. 1941.


ARCTIC OCEAN
BARENTS SEA
SVALBARD
ZEMLYA FRANTSA-IOSIFA
SEVERNAYA ZEMLYA
NOVAYA ZEMLYA
KOLSKI POL.
Murmansk
Kandalaksha
WHITE SEA
Leningrad
Arkhangelsk
Pechora R.
Sev. Dvina R.
Usa R.
Vorkuta
KOMI A.S.S.R.
MOSCOW
TAYMYR POL.
YAKUT
Yakutsk
Oimyakon
Indigirka R.
Kolyma R.
A.S.S.R.
CHUKOTSKI POL.
Chaunskaya Guba
KAMCHATKA
Magadan
Petropavlovsk
SEA OF OKHOTSK
SAKHALIN
Aldan
Amur R.
L. Baykal
Vladivostok
60°
120°

tracks had been added by the present regime and the Murmansk-Kandalaksha portion of the line electrified. A new line connecting the two cities, which had been built along the south shore of the White Sea just prior to the war, saved Murmansk from isolation when the Finns cut the railroad north of Leningrad, and, with German help, destroyed the locks and dams of the Baltic–White Sea Canal.

The wartime construction of the 700-mile railway to the Vorkuta coalfield area was of great importance in supplying the Northern Sea Route.[4] It also resulted in the building of new settlements, railway hamlets, and river ports. The building of the railroad made it possible for 10 to 12 million tons of coal to be mined during the four war years of 1941 to 1945.[5] Before the war, coal from these deposits had had to be shipped 900 miles down the Usa and Pechora rivers and then by sea to Arkhangel'sk. Together with local coal from smaller workings, such as Sangar-khaya[6] near Yakutsk on the Lena, which produced 23,000 tons in 1936, almost sufficient coal was probably made available for the vessels of the Northern Sea Route when the Svalbard source of supply was cut off in 1941.

German submarines were active in arctic waters as far east as Novaya Zemlya, and a few of them even beyond this island. They attacked both vessels coming across the North Atlantic and those plying east from Arkhangel'sk into high arctic waters. However, with the aid of three Lend-Lease icebreakers and numerous Liberty ships to supplement Papanin's fleet, cargo turnover on the Northern Sea Route proper increased 80 per cent from 1940 to 1945 (170 per cent if measured in ton-miles as the hauls were, on the average, much longer).[7] This was accomplished despite the transfer of most of the experienced high-latitude ice-reconnaissance pilots to the Soviet air transport and long-range bombing commands.

New scientific institutions were started even during the war, for example, the Northern Geographical Society,[8] set up at Murmansk in 1944, which undertook as its first problem the study of the wealth of the northern forests. Exploration was of considerable importance. Mapping of unsurveyed areas continued. Icebergs were sighted on two flights by D. B. Karelin[9] in the Polar Basin, where none were believed to exist, and their drift followed. In 1943 bergs were seen to the north of Zemlya Frantsa-Iosifa and in two places, 83°20N. and 85°40N., north of Severnaya

[4]*Information Bulletin*, 23 Dec. 1943.

[5]*Soviet News*, 12 Sept. 1946, 13 Nov. 1946, 29 May 1947; *Information Bulletin*, 19 Sept. 1944.

[6]Ivina, M., "Sangar-khaya", in *Sovetskaya Arktika*, 6 (1940), pp. 70-73.

[7]*Information Bulletin*, 12 Jan. 1946.

[8]*Information Bulletin*, 9 Dec. 1944.

[9]Karelin, D. B., "Icebergs in the Polar Basin", *Izvestiya Vsesoyuznovo Geograficheskovo Obshchestva*, Vol. 77. Pt. 3, 1945.

Zemlya in 1945. It is thought that the bergs on both flights must have originated on the eastern shore of Severnaya Zemlya. The supposed locations of Zemli Sannikova and Andreyeva were explored, and vast stretches of comparatively thin ice were found in the Polar Basin.

The Fourth 5-Year Plan: 1946-50[10]

At the present time, development of the Soviet Arctic and sub-Arctic takes place under a number of jurisdictions. The Arctic Ocean, with its islands and coasts, is the domain of the Northern Sea Route Administration (G.U.S.M.P. or Sevmorput'), except for the following regions: the shores of the Barents and White Seas, which are under normal territorial rule; 6 northern raions of the Yakut A.S.S.R., and the north and east coasts of the Sea of Okhotsk, which although arctic in terms of ice conditions, come under Dalstroi, the Far Eastern Development Corporation. The Northern Sea Route Administration owns or rents shipping installations from other government corporations in towns outside its territorial jurisdiction: Murmansk, Arkhangel'sk, Petropavlovsk-na-Kamchatke, and Vladivostok. In addition, it maintains its general headquarters as a department of the national government, in Moscow, and operates training schools at the university and industrial high school level in Leningrad,[11] where the Arctic Institute and Arctic Museum are located. Exploration remains one of its chief concerns, as do oceanography and hydrography.

Some commercial activities within the domain of the Northern Sea Route Administration which it does not control are fishing, sealing, and whaling. Scientific activities of many kinds may be carried out in the Far North by specialized institutions under other jurisdiction, or jointly with the Arctic Institute.

Development of industry on the mainland, apart from coastal areas and those serving exclusively, or primarily, the needs of northern shipping, is out of the hands of the Administration. If of national importance, such industries are the responsibility of the Ministry concerned i.e., Chaunskaya Guba tin is mined by the Ministry of the Non-Ferrous Metals Industry, and Kol'ski Poluostrov phosphates and clays by the Ministry of the Chemical Industry.[12] If of lesser importance, they may be the responsibility of the Autonomous Republics within the Russian Republic or of town governments. Cooperative, as distinct from state-owned, enterprise

[10]The full official text, in English, was published as a supplement to the *Information Bulletin* for June 1946. The 5-Year Plans of individual scientific institutions do not appear in the overall Plan, but information on them is released from time to time in different publications.

[11]Karelin, D. B., and N. Sosonkin, "Taming the Arctic", *Information Bulletin*, 18 June 1947.

[12]Field, W. O., "Kola Peninsula: Gibraltar of the Western Arctic", *Amer. Quart. on the Soviet Union*, July 1938; *Soviet News* 18 Feb. 1946, 9 March 1946.

is widespread in the outlying areas of the Soviet Union and includes native reindeer breeding, fishing, trapping and even gold prospecting. Individual enterprise, in the sense of self-employment with the aid of immediate family, but with wage labour prohibited, is also more common in the Far North than elsewhere, particularly in gold prospecting. The government is the buyer.

The current 5-Year Plan has to be considered within this framework. As a function of the national government, it deals with transport and industrial developments of national concern. In general in the Soviet Arctic the first come under the Northern Sea Route Administration, the second under the respective Ministries.

The development of transport. Under the Fourth 5-Year Plan, which was adopted as law on 18 March 1946, transport in the Arctic was to be developed as follows: "better use shall be made of the . . . Siberian and northern rivers . . . The White Sea–Baltic Canal shall be rebuilt . . . the construction of ports in the Far East completed . . . The conversion of the Northern Sea route into a normally operating sea lane shall be completed by 1950". Forward steps scheduled for 1946-50 included the building of 140 new lighthouses and 16 radio beacons and radio stations.[13] Five hundred and forty hydrographic expeditions have been planned, involving 170 voyages by ship, 200 by aircraft, and the remainder presumably on foot along the coast.

The reference to the Northern Sea Route in terms almost identical with those used in the Third Plan, suggests that capital investments had been reduced during the war, and that the increase in turnover did not mean that the waste and inefficiency of the exploration period had been eliminated.

The first of the projects to be completed was the Baltic–White Sea Canal. The reconstruction of the canal was given high priority and it was opened to traffic in 1946. Work had, in fact, started during the previous year.

A major landmark was passed in 1946 when an expedition of the Arctic Institute completed the depth sounding along the Northern Sea Route. Ice conditions in that year were exceptionally severe, and comparable with those of 1937, but the shipping season passed without mishap. Three convoys and fifteen ships travelling unescorted made the round trip between Pacific ports and Arctic ports of the Yakut A.S.S.R. and the Soviet Far East, although the Chukotski coast was so heavily ice-bound that a new course had to be found.[15] The ice-breaker *Mikoyan*, stationed

[13] *Soviet News*, 1 July 1946.
[14] *Soviet News*, 18 Nov. 1946.
[15] *Soviet News*, 4 Dec. 1946.

in this area, covered 4,000 miles in convoy duty during the season, and also broke through with supplies to ice-bound polar stations off the main route.

The Fourth 5-Year Plan does not provide for further rail or road construction in the permafrost zone—neither an extension of the Pechora railway to the sea nor a resumption of construction of the fabled Baykal-Amur northern spur of the Trans-Siberian, though both of these will undoubtedly be built at some future date. Emphasis was laid on water and on air transport. However, by 1946 the Kolyma Road from Magadan, on the north shore of the Sea of Okhotsk, was continued northward by a narrow-gauge railroad into the goldfields.[16] The Kolyma Road and the highway from the Trans-Siberian Railroad north to Tommot in the Aldan goldfields, point to future large-scale traffic.

Scientific work: Despite the progress made in exploiting and peopling the Soviet Arctic, exploration is still of the greatest importance. In the summer of 1946, the geologist Leo Berman and two associates set out to learn the cause of unprecedented summer floods on tributaries of the Indigirka rising near Oimyakon,[17] where precipitation is negligible. The party, which travelled on horseback, was unable to find guides, as no Yakut had ever followed the river to its source. After two weeks they discovered a mountain range, 95 miles long and 40 miles wide, with 60 major peaks and numerous glaciers, in an area where no mountains had been expected. The peaks, some of which reach 9,000 feet, are among the highest in the northeastern region of the Soviet mainland. The fearlessness of the mountain goats in the presence of the Berman party indicated that they had never seen human beings before. The range has been named Suntar Khayata. The flooding, which led to the expedition, was attributed to the remarkably warm summer of that year.[18]

The year 1946 also witnessed the first attempt in the Soviet sector of the Arctic to sail from the east to the west keeping north of all islands.[19] Apparently the expedition, which included thirty-five scientists, was not successful, for the writer has seen no further report, and 1946 is known to have been a very severe ice-year. The chief objective of the expedition was to study the continental shelf, since the Russians believe that the principal hydrological processes governing ice conditions in the Northern Sea Route originate on the shelf. It was also planned that a survey would be made of the boundaries of the perennial polar pack.

In 1947 the Academy of Sciences sent six expeditions to the permafrost zone and, in January, established an autonomous branch at Yakutsk,

[16] *Soviet News*, 23 Oct. 1946.

[17] Recently put forward as having the lowest recorded temperature.

[18] *Soviet News*, 25 April 1947.

[19] *Information Bulletin*, 16 Oct. 1946.

under the geologist, Sergei Smirnov.[20] One of these expeditions made an intensive study of soil formation and plant development near Igarka, which the Russians consider to be one of the coming agricultural centres of the Soviet Far North. The Arctic Institute sent out several meteorological expeditions and fourteen expeditions were equipped by the Institute of Ethnography to study the most primitive Soviet peoples; one of these it was planned would spend two to three years among the Chukchi.[21]

Two further expeditions in 1947 explored the interior of Novaya Zemlya,[22] and, travelling by tractors, surveyed the Taymyr Poluostrov, (Taimyr Peninsula) discovering coal deposits in the course of this work.[23]

The publication by the Arctic Institute of an Atlas of the Arctic, containing 300 maps, was planned for 1948.[24] This work should be a major contribution to knowledge of the Arctic. However the absence of reviews in the Soviet general and specialized press would indicate that publication has been delayed.

Since the war stimulus to scientific progress has been given by the award of a 50,000 ruble Kirov Stipend every third year, for works of discovery and development in the Kol'ski Poluostrov and the Soviet Arctic.[25]

Industrial activities: A very important development mentioned in the Fourth Plan is the sinking, during the five-year period, of new shafts with an annual capacity of 7,700,000 tons of coal in the Pechora field. These would be in addition to those already in operation; in November 1946, there were twenty, the largest of which produced 500,000 tons annually. By 1950 this construction is planned to treble the 1945 production.[26] New districts and deposits of coking coal are to be surveyed in the Pechora area by 1950, preparatory to the sinking of further mines. The resources of the Pechora field are estimated at from 120,000 to 500,000 million tons geological reserve, or more than those of the Ukrainian Donbas, now the largest producer. Drilling for petroleum, already being extracted in the region, is to be increased.

Arctic resources are becoming an integral part of Soviet industry. This was true before the war of chemicals from the Kol'ski Poluostrov. During the war the Chaunskaya Guba area on the northeastern Siberian coast became the most important tin producer in the U.S.S.R. The

[20] *Soviet News*, 29 May, 1947.
[21] *Soviet News*, 16 May 1947.
[22] *Soviet News*, 26 March 1947.
[23] *Soviet News*, 25 April 1947.
[24] *Soviet News*, 24 July 1946.
[25] *Soviet News*, 30 March 1946.
[26] *Soviet News*, 12 Sept. 1946.

Northwest Metallurgical combine, which is to use the coking coal of Pechora and the low-grade iron ore of the Kol'ski Poluostrov (as well as scrap from the Moscow district) for the first pig-iron-to-steel plant in the Leningrad area is an important subarctic development.

The Fourth Plan also provides for an increase in lumber-milling along the Severnaya Dvina and Pechora rivers. New narrow-gauge timber railways were under construction in the Komi A.S.S.R. of the European North from 1946 onwards.

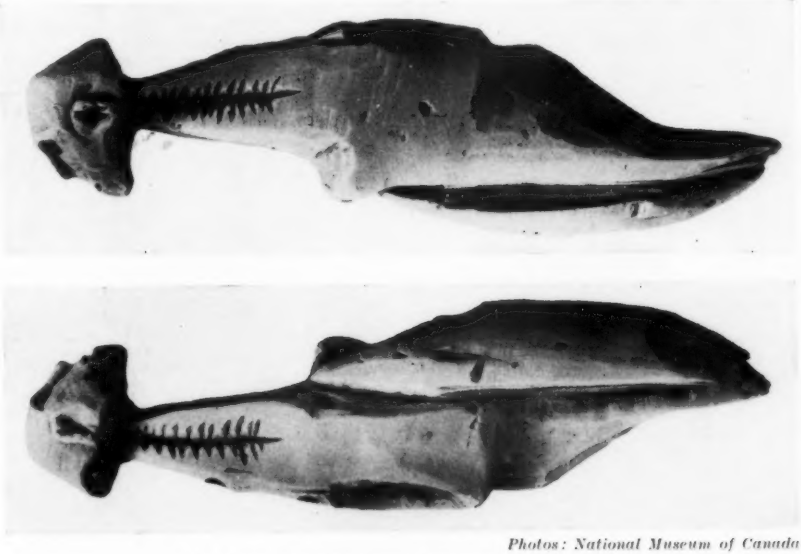
The arctic fisheries have provided an important part of the Soviet food supply since the institution of the Five-Year Plans. The catch in the western Arctic had increased from 13,000 tons in 1913 to 277,900 in 1937. In the latter year the Murmansk trawler fleet had grown to 80 vessels; canneries had been built at Murmansk and Kandalaksha, and refrigerator cars were operated on daily schedule to carry fresh fish to the inland cities. The Fourth Plan provides that "fishing shall be widely extended in the Northern and Far Eastern waters, especially off South Sakhalin, the Kurile Islands and Kamchatka". Far Eastern waters, most of them northerly, had provided 30 per cent of the entire Soviet catch in 1940. Fish, it is to be remembered, is the staple source of protein in the Russian diet.

Judging by the record to date and by the objectives of the Fourth Plan, it may be surmised that by 1950 many of the problems of industrial expansion and of providing cheap transport in the Soviet Arctic will have been solved. Vast fields for expansion will however remain. Until a diet acceptable to Europeans can be produced locally the density of population in the Soviet Arctic will remain infinitesmal by comparison with that of the non-Arctic regions.

AN UNUSUAL ARCHAEOLOGICAL SPECIMEN FROM FOXE BASIN

By **Graham Rowley**

While at Igloolik in August 1949, I was brought a number of archaeological specimens which had been collected by Eskimo from the many old houses in the area. Excavation of this type is, of course, to be deplored and is now discouraged by most of the white residents in the North, especially since the collection of archaeological specimens in the Northwest Territories without a licence has been prohibited. With little or no accompanying data the specimens are usually of negligible interest. It is difficult however to tell the Eskimo to take them away as their small residual value would then be lost. The only course seems to be to accept them, tell the Eskimo that they should not dig them up and give them so insignificant a reward that they will not be encouraged to continue.



Photos: National Museum of Canada

Side views, showing resemblance to a whale. X 2

Most of the specimens brought to me were said to have come from some old houses at Pingerqalik, on the east coast of Melville Peninsula some twenty-five miles south of Igloolik Island, presumably from the site sketched by Mathiassen.[1] They are mainly of Thule types but there are

[1]Mathiassen, Therkel, "Archaeology of the Central Eskimo". Rep. Fifth Thule Exped., 1921-24. Copenhagen, 1927, Vol. IV, Pt. I, p. 119.

a small number which are certainly Dorset. One of the Pingerqalik artifacts is of considerable interest as it has both Thule and Dorset characteristics. It bears a slight, probably fortuitous, resemblance to a toy whale, and is a toggle of some sort, possibly for the end of a piece of skin-line used for dragging seals over the ice, but more likely a fastening for a belt.

Photos: National Museum of Canada

Top and bottom views, showing drilled hole and pits and the two seals. X 2

The specimen is made from a walrus-tooth not tusk. It is highly decorated in undoubted Dorset style. At one end is a human head in front of a fox head. Both these are Dorset, as are two small seals carved in relief on the underside. I have excavated similar seal carvings at the pure Dorset site of Abverdjar, only about thirty miles from Pingerqalik. The line hole right through the specimen is, on the other hand, Thule, or

at least is certainly not Dorset, while a number of small pits are also drilled and therefore cannot be Dorset. There are ten of these small pits, four of which form the eyes of the fox and human heads, while the other six which have no obvious significance are arranged symmetrically in pairs on the upper side.

With two cultures represented on the same artifact it may be possible to determine their relative ages. In this case the patina, which is light orange brown and consistent over the whole specimen, is of no help, except to indicate that the specimen is probably old and has not been reworked in modern times. The line hole does however give clear evidence of having been added later than the Dorset carving. It is drilled slightly to one side, apparently to avoid the carving. It has also just touched one of the seals and has cut away the deep groove at the side of this seal. It could not therefore have been earlier.

The walrus tooth had probably been carved by the Dorset people with no particular purpose in view, and had then been lost or discarded. Later, in Thule times it had been found and considered suitable for making into a toggle. The eyes of the fox and human heads were presumably first gouged in the normal Dorset style. The small drilled pits which now form the eyes and the other drilled pits must represent later touching up, probably at the time when the line hole was drilled.

The importance of this specimen is that it affords additional evidence that the Dorset culture antedates the Thule. It is now in the collection of the National Museum of Canada.

Photo: National Museum of Canada

Human head. X 4

REVIEW ARTICLE

THE UPPER AIR OVER NORTHERN CANADA

AEROLOGICAL DATA FOR NORTHERN CANADA. *By* T. J. G. HENRY *and* G. R. ARMSTRONG. *Toronto: Dept. of Transport, Meteorological Division, 1949. 11 x 8½ inches; 271 pages; maps and diagrams. 75 cents.*

It is a pleasure to record the publication of a major contribution to the climatology of the Arctic. The Canadian Meteorological Division has collected and analysed the results of the first few years of upper air sounding at stations in Northern Canada. The report, 'Aerological data for northern Canada', written by T. J. G. Henry and G. R. Armstrong, is by far the most significant document yet published on the climate of the Canadian Arctic, which has been closed territory until quite recently for all but surface observation.

Henry and Armstrong have followed traditional lines in the preparation of their report. After a thorough analysis of the accuracy of their methods, they discuss at length the normal state of the atmosphere over Northern Canada. Their account is illustrated by a series of normal temperature and pressure maps for four months (January, April, July, October) and at four levels (850, 700, 500 and 300 millibars, or roughly 5, 10, 18 and 30 thousand feet). In accordance with latest aerological practice, the charts are drawn for standard isobaric surfaces, the topography being shown by contours indicating dynamic heights. In the free atmosphere, the prevailing winds blow parallel to these contours, at a speed proportional to the local gradient; the maps therefore show at a glance the normal pattern of flow up to the base of the stratosphere. They cover the whole Dominion north of 50°N.

Of special interest is the authors' review of the characteristics of the Arctic tropopause. It has been reported[1] that no clear cut division of the atmosphere into troposphere and stratosphere can be attempted for a considerable winter period in the Antarctic. Henry and Armstrong find evidence for occasional marked stability in the upper troposphere, but cannot find any true parallel for the disappearing tropopause discussed by Court. The average level and physical characteristics of the tropopause are given for all months at all the stations analysed, and the tropopause appears as definite in winter as in the other seasons.

The general discussion ends with an attempt to fit the work described into the new ideas about the atmospheric circulation recently developed in the University of Chicago by E. Palmén and others–the "jet stream" hypothesis. This attempt is the least successful part of the report, probably because the jet stream has not yet won for itself a secure enough place nor a rich enough professional vocabulary in which to discuss it easily. The authors give the impression that they would have been happy to prove a closer relationship than they could actually manage.

The tables at the end of the report occupy no less than 229 pages. They give (i) average surface conditions for each month, (ii) upper wind summaries to 8 km. (26,247 ft.) from pilot balloon observations, and (iii) monthly averages of radiosonde data, i.e. pressure, temperature and humidity, to the upper limit of ascent, tabulated in individual years, with whole period means. The radiosonde data are further illustrated by uniform temperature-height diagrams, on which extreme values as well as averages are plotted. The stations used are in part Canadian, in part U.S. operated, but most of them are Canadian operated with U.S. radiosonde equipment, a very happy team arrangement. In view of the value of the data, it is worth while listing these stations in this review.

[1]Court, A., "Tropopause disappearance during the Antarctic winter," *Bull. Amer. Met. Soc.*, Vol. 23 (1942) pp. 220-238.

Station	Radiosonde Data	Pilot Balloon Data	Operated By	Type of Radiosonde
Aklavik	Sept. 42–Aug. 47	Jan. 44–Feb. 47	Can.	Can.
Fort Nelson	Mar. 42–Aug. 47	Jan. 43–Feb. 47	Can.	Can.
Port Harrison	Oct. 43–Aug. 47	Nov. 37–Aug. 47	Can.	U.S.
Clyde River	Jan.–Feb. 43; Apr.–Aug. 45	—	U.S.	U.S.
Upper Frobisher Bay	Mar. 43–July 47	Mar. 42–Nov. 43	U.S.	U.S.
Fort Chimo	Jan. 44–Dec. 45	Nov. 41–Oct. 43	U.S.	U.S.
Arctic Bay	Apr. 43–Aug. 47	Nov. 43–Aug. 46	Can./Nov. 43	U.S.
Churchill	June 43–July 47	Sept. 45–Aug. 47	Can./Aug. 45	U.S.
Coral Harbour	Nov. 43–Oct. 47	Oct. 45–July 47	Can./Sept. 45	U.S.
Fort Smith	Dec. 43–Aug. 47	Dec. 44–Feb. 47	Can./Dec. 44	U.S.
Norman Wells	Mar. 44–Aug. 47	Jan. 45–Oct. 46	Can./Jan. 45	U.S.
Whitehorse	July–Dec. 44; May 46–Aug. 47	Jan. 44–Jan. 47	Can./May 46	U.S.
Chesterfield	—	Jan. 44–June 48	Can.	—
Fort Simpson	—	Jan. 45–Feb. 48	Can./Dec. 44	—
Hay River	—	Dec. 44–Jan. 47	Can./Nov. 44	—
Watson Lake	—	Jan. 44–June 48	Can.	—
Yellowknife	—	Jan. 45–Nov. 47	Can.	—

This report will be of value to engineers, aviators, and the Services generally. Its greatest value, however, is scientific, and the Canadian Meteorological Division and the Defence Research Board have, by this publication, made a most valuable contribution to our knowledge. We may hope that it is only the first of a series of such studies of various aspects of the Canadian North. There is probably no region in the world so well worth studying. It is refreshing, too, to note that, in spite of the official character of the report, credit can be given to the authors by name for their distinguished work and it is to be hoped that this practice will be followed in the future.

F. Kenneth Hare

REVIEWS

FRANKLIN OF THE ARCTIC.

By Richard S. Lambert. *Toronto: McClelland and Stewart, 1949. 8 x 5½ inches; 338 pages; illustrations. $3.50.*

I believe the publishers have done Mr. Lambert a disservice in stating that this tale is told for youngsters and "will enrich the classroom." If certain liberties with unwitnessed situations and a simplicity of style make this a children's book, then it is a pity that more biographies of adventurous men are not written in this way. 'Franklin of the Arctic' is a full and stirring story of the life of the discoverer of the Northwest Passage, from his boyhood to his death on board the imprisoned *Erebus*. Only a few errors mar the essential accuracy of the account. On page 191 for instance George Back's gallant trip to obtain extra food was not carried out alone; on p. 308, McClure's ship did not drift right through the Passage but was abandoned on Banks Island whence he continued by sledge, and last, on the same page the British Government's expenditure on the Franklin search was a thousand-fold less than stated. This unfortunate error has been seized on as marvellous by another reviewer of this book—indeed it would be, if true. The author in an appendix gives a good bibliography concerning Franklin and has obviously studied these works with enthusiasm and care. He does not speculate on where Franklin was buried. Was it at sea or on land? The answer to this and to other mysteries of the last undocumented voyage may yet be given: this is the continuing fascination of the Franklin story.

P. D. Baird

FUNDAMENTALS OF ARCTIC AND COLD WEATHER MEDICINE AND DENTISTRY.

By H. B. Eisberg and J. E. Owens. *Washington, D.C.: Research Division, Bureau of Medicine and Surgery, U.S. Navy Dept., 1949. 9 x 5¾ inches; vii + 204 pages; diagrams and illustrations.*

Commander Eisberg and Lieut. Owens of the U.S. Navy, are to be congratulated on gathering so much useful information together. In fact their book covers much more than the title would suggest, and attempts to provide a general grounding in arctic matters, with the emphasis on medical and dental considerations. The result is that a certain amount of irrelevant detail is included.

A few minor points may be criticized though these do not seriously detract from the book in any way. The material is sometimes rather scattered, which makes reference difficult, particularly as there is no index. For instance, foods, which are covered on p. 13 and following, are mentioned again in part on p. 153-4. On p. 153, it is stated, without apparent qualification, that a large amount of food is available in the Arctic. The advantages of plants for survival purposes are stressed, fifty pages being devoted to arctic flora, whereas no reference appears to be made to the greater advantages of hunting for survival. The survivor who has no gun might be cheered to know the ease with which ptarmigan can be secured.

A statement should have been included on p. 74, that the real dangers of carbon monoxide in tents and other closed spaces when cooking with gasoline or naphtha stoves comes from placing pots over the flame. Carbon monoxide dangers are much less with a bare flame.

On p. 81 it is stated that diffusion of water vapour through clothing is undesirable. In general this diffusion is desirable providing that air permeability of the fabrics is sufficiently reduced.

The German work on hypothermia with human subjects is accurately described, but the unreliable character of the investigator might have been mentioned before adopting his conclusions and applying them as a general rule.

Attention could be drawn to a number of other small points, such as the assumption on p. 138 that ice crystals are the cause of opacity in frostbitten tissues, which is without justification, and the careless handling of the R.C.M.P. on pages 10 and 115. But the book as a whole is gratifyingly complete. Instruction on first aid care for survivors while awaiting rescue, would have been valuable in a book of this type, and could be added to a second edition.

M.G.W.

INSTITUTE NEWS

Award of Arctic Institute grants

The following have been awarded grants by the Arctic Institute for field work in the 1950 season:

Baird, Patrick Douglas, Montreal Office of the Arctic Institute, Quebec, Canada.
Joint scientific expedition to study the ice cap inland from Clyde River, east Baffin Island, and the permafrost, zoology, botany, geology, and geomorphology of the surrounding district and coastal mountains.

Benson, Lyman David, Pomona College, Claremont, California, U.S.A.
Field population studies of *Ranunculus* species occurring in northern Alaska.

Buss, Irven O., State College of Washington, Pullman, Washington, U.S.A.
Studies of territory, breeding behaviour, range requirement and breeding density of the Upland Plover at the northern extremity of its range.

Cade, Tommy J., University of Alaska, College, Alaska.
A complete survey of the avifauna of St. Lawrence Island, Alaska, particularly of the feeding and nesting habits, and the ecological associations of the various species.

Carpenter, Edmund Snow, University of Toronto, Toronto, Ontario, Canada.
Archaeological, geological and ethnological investigations at Southampton Island.

DE LAGUNA, FREDERICA, Bryn Mawr College, Bryn Mawr, Pennsylvania, U.S.A.
Ethnological and archaeological survey of the northern Tlingit, in southeastern Alaska.

HAMMERICH, LOUIS L., University of Copenhagen, Copenhagen, Denmark.
A study of the language of the Nuniwagamiut Eskimo, at Nunivak Island, Alaska.

HANSEN, H. P., Graduate School, Oregon State College, Corvallis, Oregon, U.S.A.
Pollen analysis of peat sections along the Alaskan Highway.

HANSON, HERBERT C., The Catholic University of America, Washington, D.C., U.S.A.
Location and condition of reindeer range and management of reindeer in western Alaska.

HARP, ELMER, JR., Dartmouth College, Hanover, New Hampshire, U.S.A.
Archaeological reconnaissance along the west coast of Newfoundland.

HØST, PER, American Museum of Natural History, New York, New York, U.S.A.
A study of the Hooded Seals in the Newfoundland - Labrador - Greenland region.

JORDAL, LOUIS HENDRIK, University of Michigan, Ann Arbor, Michigan, U.S.A.
A floristic, phytogeographical and ecological survey of the vegetation on the Brooks Range in arctic Alaska.

KENK, ROMAN, 3350 Blaine Street, N.E., Washington, D.C., U.S.A.
Investigation of ecology and zoö-geographical significance of lower fresh-water invertebrates in arctic Alaska, in particular fresh-water triclads (Turbellaria).

LAWRENCE, DONALD B., University of Minnesota, Minneapolis, Minnesota, U.S.A.
Recent glacier history of Glacier Bay, Alaska, and development of vegetation on deglaciated terrain with special reference to the importance of alder in the succession.

LEARMONTH, L. A., Box No. 283, Georgetown, Ontario, Canada.
Archaeological reconnaissance of King William Island, Boothia Peninsula region.

MUSACCHIA, XAVIER JOSEPH, St. Louis University, St. Louis, Missouri, U.S.A.
Histochemical investigations of carbohydrates and lipids in the invertebrates and the vertebrates of the Point Barrow region.

NUTT, DAVID CLARK, Dartmouth College, Hanover, New Hampshire, U.S.A.
Continuation of oceanographic and marine biological investigations initiated in 1949 in the coastal waters of Labrador.

OSWALT, WENDELL HILLMAN, University of Alaska, College, Alaska.
An archaeological survey from the south mouth of the Yukon River, Alaska, to Hazen Bay, with the excavation of the most promising site located.

SCOTT, ROBERT FALCON, Wildlife Management. Anchorage, Alaska.
An aerial survey of Dall sheep in Alaska to determine limits of range, and present distribution and abundance.

SHIMKIN, DEMITRI BORIS, Russian Research Center, Harvard University, Cambridge, Massachusetts, U.S.A.
Investigation of the economy of the Yukon Valley of Alaska and a survey of the villages of Tanana and Unalakleet.

SULLIVAN, BERNARD J., Boston College, Chestnut Hill, Massachusetts, U.S.A.
Biochemical and histochemical analysis of the tissues of certain arctic animals, to determine the amount present and localization of lipids, glucose, and glycogen.

THOMPSON, DOROTHY JEAN T., Harvard University, (Radcliffe), Cambridge, Massachusetts, U.S.A.
A study of the social and economic organization in a northern market town (Nome, Alaska) with emphasis on the position of the Eskimo.

THOMSON, JOHN WALTER, JR., University of Wisconsin, Madison, Wisconsin, U.S.A.
A study of the lichens of the west coast of Hudson Bay; their ecology, distribution and abundance.

WILBER, CHARLES GRADY, St. Louis University, St. Louis, Missouri, U.S.A.
Biochemical characteristics of arctic animals.

ARCTIC INSTITUTE RESEARCH REPORTS

The following reports describe some of the work carried out with the assistance of Arctic Institute grants during the field season of 1949.

Archaeology

Archaeological Reconnaissance in Southern Labrador and Northern Newfoundland

Elmer Harp, Jr., and a student assistant from Dartmouth College, accompanied the *Blue Dolphin* expedition to carry out archaeological work in Newfoundland and Labrador. They planned to study the culture of the Beothuk Indians of Newfoundland, to re-examine the Cape Dorset Eskimo remains first discovered in western Newfoundland by Wintemberg in 1929, and to examine the possibility of cultural relationship between these two early peoples. The Strait of Belle Isle area was chosen for the first summer's work, as it was thought that it might be the bridgehead for the earliest migration to Newfoundland.

The archaeological work in southern Labrador was started while the *Blue Dolphin* was in the Strait of Belle Isle. Early in June, Mr. Harp left the ship at St. Anthony, Newfoundland, and continued westwards round the island by small boat to Corner Brook, where he joined the *Blue Dolphin* on September 1 for the return voyage.

In Labrador, seventeen sites were investigated. Seven in Pinware Bay, three in the vicinity of West St. Modeste, two in L'Anse au Diable, two in L'Anse au Loup, and three in Forteau Bay. The largest sites, which cover a considerable area of ground, are found on the sandy flood plains of rivers and streams which enter the various bays. Other sites appear to be correlated with raised beaches on both sides of the Strait of Belle Isle. Levelling traverses run from present sea-level to determine the elevations of the raised beaches and actual site locations may assist relative dating of the occupations. The old occupation levels in many cases were found in buried turf horizons, from one to three feet below the present ground surface. The material collected in Labrador appears to be of Indian origin; it includes a wide assortment of large and small points and blades, polished stone axes, adzes and gouges; side-and-end scrapers and utilized flakes; several specimens of ground slate blades, all of which show signs of long or severe weathering; and large chopping tools, knives, and semi-lunars chipped from quartsite. No evidence of the Dorset Eskimo culture was discovered in southern Labrador. The ruins of seven stone dwellings found in Forteau Bay are probably of more recent Eskimo culture.

In Newfoundland, thirteen sites were investigated. Two of these were found on a quick reconnaissance in Hare Bay, on the northeastern coast. The other eleven sites are on the western coast; seven in the area of Riche Point, one on Keppel Island in Hawke Bay, and three in Bonne Bay. Several of these had first been visited by Wintemberg in 1929, but they were rechecked for additional material.

Both in Port au Choix (Riche Point) and Bonne Bay the artifacts obtained seemed similar to those from sites on the Labrador side of the Strait. In adjacent sites Dorset-like material occurred; small snubnosed scrapers; lamellar flakes of flint and quartz, some of them retouched and notched for hafting; small triangular points with concave bases, retouched on one side only; fragments of ground slate blades; steatite vessels; and a few bone implements, although none of the typical Dorset harpoon points was discovered. In one site a series of house pits was detected, and one of them was excavated.

It appears that Port au Choix, and the stretch of coast to the south of it may be a key area for studying the relationship between early Indians and Eskimo.

Biology

Study of vegetation types in Alaska in relation to soil profiles and solifluction

Dr. Herbert C. Hanson studied over 100 stands of vegetation types, chiefly grasslands, in various parts of Alaska during June, July, and August. The botanical composition of the majority of the stands was analyzed by the point-

contact method to secure quantitative data on the extent of cover and the frequency of the species represented in each stand. Trenches were dug to examine the soil profiles, and to obtain data on the pH of the various horizons and the root distribution, particularly the working and maximum depths. Much new information was secured, not only on the nature of these stands, but also on the plant succession, land formation, relation to erosion, and solifluction.

Study of the cryptogams of the Arctic Slope of Alaska

Dr. George Llano reached Point Barrow early in June to study the lichens of the Arctic Slope of Alaska. He had been offered the facilities of the Arctic Research Laboratory at Barrow and made the laboratory his headquarters, travelling by aircraft to different regions. Conditions for immediate fieldwork were most favourable at Wainwright, an Eskimo village on the coast about 100 miles west of Point Barrow. The lichen flora around Wainwright was rather uniform and poor in species. Later work showed that this condition is probably characteristic of the entire, low to slightly rolling, coastal tundra belt. The survey of the Wainwright area was extended by an early thaw which prevented the aircraft landing on the sea ice.

It had been arranged that Dr. Llano, Dr. Neal Weber, entomologist, Dr. Robert Rausch, parasitologist and mammalogist, Mr. Lloyd Spetzman, botanist, and Mr. Vladimir Walters, ichthyologist, should join together for purposes of travel. Dr. Weber and Mr. Spetzman had also received grants from the Arctic Institute.

The next district visited was Anaktuvuk Pass, a broad gateway through the Brooks Range, which drains to both the Colville and to the Yukon River systems. The seasonal migration routes of many animals lie through this pass, which is the traditional hunting ground of the Killik River Eskimo. Several families were camped at the north end of the large springs which pour into Tugulak Lake, where the party made their base. The upland alpine meadows were rich in lichens and flowering plants. The lower areas were drier with some badly drained areas in which cotton grass predominated. Willows, alders and a rare patch of stunted poplars bordered the lake and river banks. There were abundant signs of mountain sheep and caribou.

On July 20 the party left for Umiat on the Colville River. Here the grass-sedge association predominated except along the ridges, where lichens were more conspicuous.

Other regions investigated included Half Moon Three, the Brower's reindeer ranch south of Point Barrow, Point Barrow, and on the return trip the following islands in the Aleutian Chain: Adak, Great Sitka, Amchitka, Attu, Shemya and Kodiak.

The role of lipids in the adaptation of animals to various climates

Dr. Xavier J. Musacchia and two assistants were given quarters and laboratory facilities at the Arctic Research Laboratory, at Point Barrow, to carry out research on the role of lipids in the adaptation of animals to various climates. The total number of animals under investigation exceeds 150. Particular studies have been made of the following: Sabine gull, loon, jaeger, king eider, arctic owl, bearded seal, ground squirrel, whitefish, sculpin, blackfish, arctic cod, grunion, sea cucumber, sea urchin, and crab.

Study of peripheral circulation in the Eskimo

Under Dr. Malcolm Brown's direction Dr. J. D. Hatcher and Mr. John Page of the Queen's University Medical Expedition to Southampton Island made a preliminary study of skin and muscle temperature and blood flow in the forearm and hand of the Eskimo. Approximately thirty-five determinations of skin, subcutaneous, and muscle temperature were made using thermocouples immediately after the forearm was bared. The forearm blood flow and skin, subcutaneous, and muscle temperature were recorded in the clothed forearm, and in water baths of various temperatures. No significant difference was detected in the response of the Eskimo from that observed in the White man in temperate climates.

GEOGRAPHICAL NAMES IN THE NORTHWEST TERRITORIES

The Canadian Board on Geographical Names has recently adopted the following names for official use in the Northwest Territories. For convenience of reference the names are listed under the respective sheets of the 8 Mile to 1 Inch Map of the National Topographic Series.

Cape Dyer, 16 N.W. and 16 N.E.
(Adopted on 5 May 1949)

Kangert Fiord	67°04N.,	63°34W.	formerly Kangertloaping Fiord
Kekertuk Settlement	67 33	63 44	" Kekertukdjuak Settlement

(Adopted on 16 January 1950)

St. Roch Harbour	66 54	62 09

Rae, 85 N.W. and 85 N.E. (Adopted on 7 April 1949)

Emile River	63°30N.,	116°23W. not Émile River

Simpson-Liard, 95 S.E. (Adopted on 2 March 1950)

Arrowhead River	60°25N.,	122°18W.	Nahanni Range	61°13N.,	123°16W.
Bluefish Mountain	61 08	123 30	Norwegian Lake	61 45	120 16
Celibeta Lake	60 13	122 20	Pointed Mountain	60 26	123 57
Cli Lake	61 58	123 20	Sawmill Mountain	60 48	123 40
Flett Rapids	60 42	123 32	Sibbeston Lake	60 45	122 47
Goose Lake	61 18	121 16	Tetcho Lake	60 25	120 45
Liard Range	60 37	123 46	Tsetso Lake	61 51	123 02
Little Doctor Lake	61 53	123 13			

Antoine Lake	61 44	121 38	not Jackfish Lake
Fisherman Lake	60 21	123 45	" Fish Lake
Jean-Marie Creek	61 28	121 10	" Jean Marie Creek
Mount Flett	60 41	123 40	" Flett Mountain
Mustard Lake	62 06	120 05	" Trout Lake
Yohin Lake	61 13	123 47	" Jackfish Lake

Wholdaia Lake, 75 S.E. (Adopted on 7 July 1949)

Desmarais Lake	60°39N.,	105°33W. not Desmaris Lake

Wrigley, 95 N.W. and N.E. (Adopted on 7 April 1949)

Trail Creek	62°11N.,	122°04W. not Trail River

ELECTIONS OF FELLOWS

At the meeting of the Board of Governors held in Montreal on 10 March 1950 the following were elected Fellows of the Institute:

Dr. Tyge W. Bøcher, Charlottenlund, Denmark.
Provst Aage Bugge, Søllerød, Holte, Denmark.
Dr. Magnus Degerbøl, Lyngby, Denmark.
Dr. Poul Marinus Hansen, Charlottenlund, Denmark.
Erik Holtved, Søborg, Denmark.
Helge Larsen, Copenhagen, Denmark (presently at College, Alaska).
Prof. G. E. MacGinitie, Fairbanks, Alaska.
Professor Niels Nielsen, Copenhagen F, Denmark.
Professor Arne Noe-Nygaard, Copenhagen K, Denmark.
Professor Alfred Rosenkrantz, Copenhagen S, Denmark.
Dr. Finn Salomonsen, Copenhagen K, Denmark.
Vice Admiral A. H. Vedel, Hellerup, Denmark.
Christian Vibe, Søborg, Denmark.